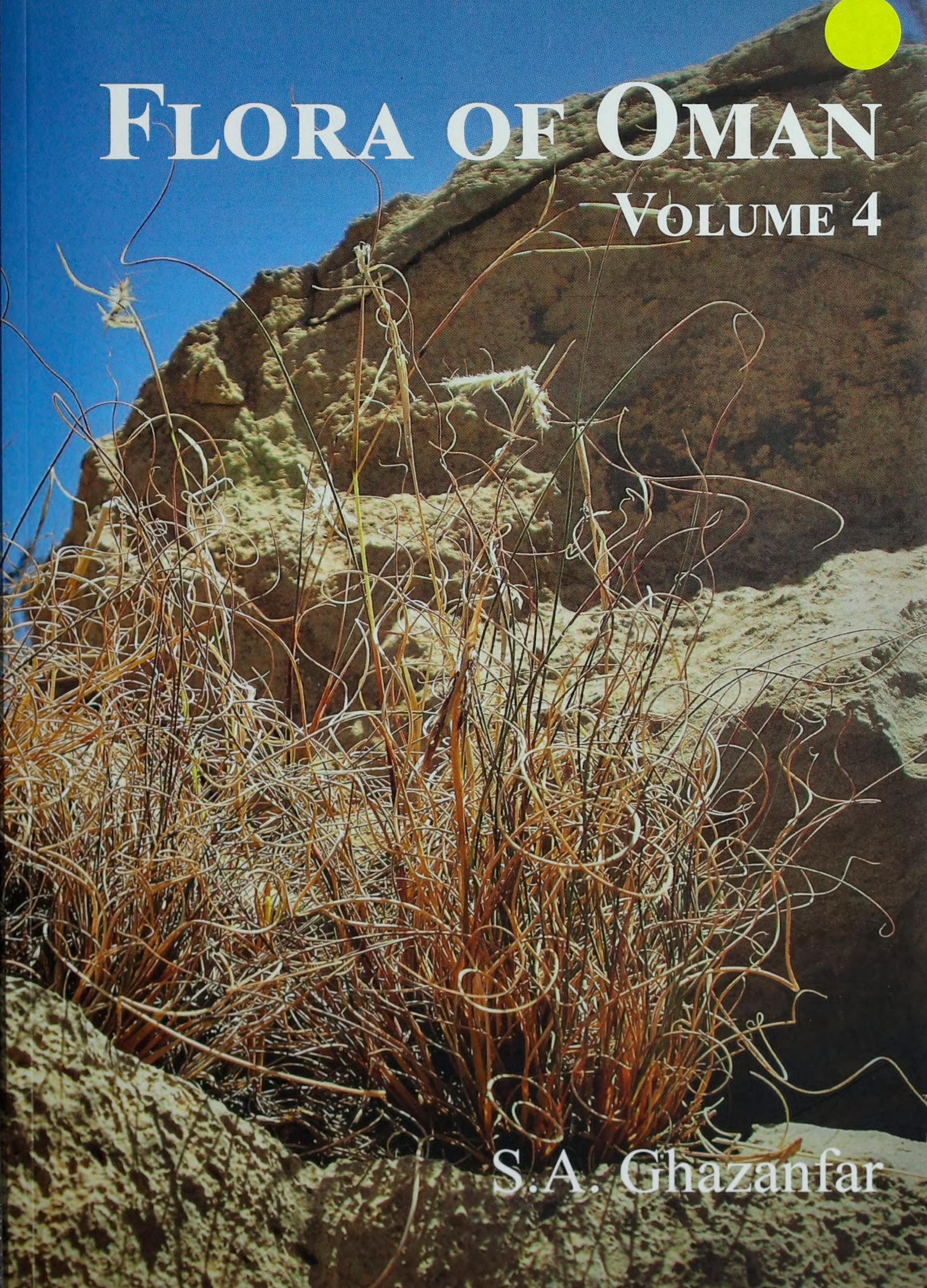
Flora of Oman

Volume 4



S.A. Ghazanfar

Abbreviations and Transliteration

Standard botanical abbreviations of Latin words used in the text are listed below.

aff.	affinis: akin to
auct.	auctorum: of authors
c.	circa: about
in sched.	in schedula: on herbarium label or sheet
loc. cit.	loco citato: on the page previously cited
nom.	nomen: name
nom. conserv.	nomen conservandum: conserved name
nom. illegit.	nomen illegitimum: illegitimate name
nom. nud.	nomen nudum: name unaccompanied by a description
n.v.	non vidi: not seen
op. cit.	opere citato: in the work previously cited
p.p.	pro parte: in part
s.n.	sine numero: without number
s.l.	sensu lato: in a broad sense
s.str.	sensu stricto: in the strict sense

Arabic, Harsusi and Jibbali names are transliterated using the BGN/PCGN 1956 System (US Board on Geographical Names and the Permanent Committee on Geographical Names for British Official Use).

	Arabic	Romanization		Arabic	Romanization
Alif	ا	a	Dad	ض	d.
Ba	ب	b	ta	ط	t
Ta	ت	t	Za	ظ	z
Tha	ث	th	‘Ayn	ع	‘
Jim	ج	j	Ghayn	غ	gh
Ha	ح	h.	Fa	ف	f
Kha	خ	kh	Qaf	ق	q
Da	د	d	Kaf	ك	k
Dha	ذ	dh	Lam	ل	l
Ra	ر	r	Mim	م	m
Za	ز	z	Nān	ن	n
Sin	س	s	Ha	ه	h
Shin	ش	sh	Waw	و	w
Sad	ص	S	Ya	ى	y

Scripta Botanica Belgica 56

Cover illustration:
Cymbopogon schoenanthus. Photo Zomo S.Y. Fisher

Illustration page i:
Phoenix dactylifera. Drawn by S.A. Ghazanfar

Inside

Abbreviations and Transliteration

Shahina A. Ghazanfar

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of the
Sultanate of Oman

Volume 4
Hydrocharitaceae - Orchidaceae

05 DEC. 2018

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Cover illustration: *Cymbopogon schoenanthus*. Photo: Zomo S.Y. Fisher
Illustration page i: *Phoenix dactylifera*. Drawing by S.A. Ghazanfar

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Foreword

When Shahina arrived in the Sultanate of Oman in 1987 she discovered for herself a country rich in history, culture and landscapes and, most intriguingly, plant diversity. She also discovered that knowledge of this diversity was dispersed, fragmented and in some aspects non-existent. This juxtaposition of the known and the unknown inspired what became a labour of devotion – this Flora of Oman.

The major biogeographical influences on this flora come from South West Asia and Africa, the regions where Shahina had been studying prior to her arrival. She was thus perfectly positioned intellectually to begin the task she set herself. Building on the researches of those who had gone before, from the early 19th century plant collector Pierre Martin Rémi Aucher-Éloy, whose footsteps she retraced, to the plant collectors and botanists of the late 20th century, Shahina began her own explorations of the landscapes and plants of Oman.

I had the good fortune to be party to many of these travels. I thus bear witness to the fact that Oman's landscape and complex geomorphology has produced a richness all of its own, left unexplored in research to produce a comprehensive Flora.

Shahina's travels throughout Oman, from Musandam in the far north, through the precipitous northern mountains and its idyllic foothills and wadis, through the enigmatic Jiddat al Harasis, and on to the verdancy of Dhofar in the south, yielded many botanical surprises. Besides the discovery of new plant species, these voyages provided Shahina with an unrivalled insight into the biogeography and ecology of Oman's plants. But most importantly, these explorations provided the secure foundation on which this Flora has been built, and that I celebrate here.

As Henk Beentje noted in the foreword to Volume 3 of this Flora – every country should have one – for reasons so obvious that I do not need to elucidate them. Having been present at the inception of this project I am happy to mark here that, with the publication of this final volume, and with the long-term support of Botanic Garden Meise, Oman now has its Flora. The four volumes of this singular undertaking provide the student of botany and the curious traveller alike with a detailed, scholarly, comprehensive and unrivalled overview of the plant diversity of the Sultanate of Oman.

Martin Fisher
Fauna & Flora International
Cambridge, UK

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Supplementary documentation

Photographs of taxa https://doi.org/10.5281/zenodo.1453300

Index of Latin and vernacular names https://doi.org/10.5281/zenodo.1453300

Acknowledgements

As for the other volumes, most of the work for this final volume was carried out in the Sultanate of Oman while I was at Sultan Qaboos University. For this, I thank several of my colleagues, a few still at Sultan Qaboos University, others now retired and living elsewhere. I have lost a few friends: Michael Gallagher, who was instrumental in starting the National Herbarium (ON) at the Natural History Museum in Oman, and who helped me in every way he could while I was there, David Insall, who assisted with several new plant distribution records and vernacular names of many plants on the Eastern Hajar, Roddy Jones, whose immense knowledge of the natural environment of the country helped me tremendously in my pursuit of plants and their uses, Sheila Collenette whose excellent collections from Oman I have used many times for this and the other volumes. These friends are no longer in this world, but have left a legacy to work with.

Many colleagues and friends have given me their time, advice and help during the production of this volume; I thank them all. In particular, I would like to mention Tom Cope for his contribution of the Poaceae, without which this volume could not have been complete. I thank Jane Browning for help with names of an initial list of the Cyperaceae, Lorna McKinnon for her contribution to the Cyperaceae, Sabina Knees, and Tony Miller for their help on several occasions to my inquires. Once more I am grateful to my sons, Tipu, Ali and Zomo and their partners, Nadia, Zureen and Vasco for their continued support.

Many thanks to Ivan Hoste, and to Botanic Garden Meise (Belgium), for their continuous support and the publication of the Flora of Oman.

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Preface

The fourth and final volume of the Flora of the Sultanate of Oman completes the descriptive accounts and species distribution maps of the flora of Oman. The final volume deals with monocotyledonous families: 305 taxa in 21 families. Cronquist's (1981) system is fol- lowed here, but I have included explanatory notes where APG IV (2016) classification or recent molecular evidence treats a family or genus differently. This volume includes the monocots with the Oman flora represented in orders (in APG IV): Alismatales, Arecales, Asparagales, Commelinales, Liliales and Poales. For each species, the format follows as for the other three volumes with the illustration number same as the number of the distribution map.

Tom A. Cope has contributed the Poaceae, the largest family in this volume with over 200 taxa. It is adapted from the treatment of the family in the Flora of the Arabian Peninsula and Socotra 2007, vol. 5, part 1 (publ. Edinburgh University Press). John Lavranos has contributed, in part, to the family Aloaceae and C. Coston and Sabina G. Knees have contributed Habenaria in the Orchidaceae. Lorna McKinnon has edited the account of the Cyperaceae.

For many of the species described, especially in the Cyperaceae and Poaceae, I could not find suitable images, but I have added reference to a good illustration where such was available.

Distribution maps for all species in this volume are made using herbarium label data. As for the other volumes, the dot on the distribution maps represents the presence of a taxon in a 25 × 25 km square on a 100 × 100 km UTM grid on the map. For this volume all photographs of taxa included, and an index of vernacular names (vernacular to Latin and Latin to vernacular), are prepared as an Annex published digitally (https://doi.org/10.5281/zenodo.1453300). The order of photographs in this document is the same order as that of the families, genera and species in the printed Flora, and map numbers correspond to distribution maps published in the printed text. Geo-referenced locations for most species and images of herbarium sheets are available on-line from databased collections at the Royal Botanic Garden, Edinburgh (E) [http://elmer.rbge.org.uk/bgbase/vherb/bgbasevherb.php], Royal Botanic Gardens, Kew (K) [http://apps.kew.org/herbcat/navigator.do], Natural History Museum Vienna (W) [http://herbarium.univie.ac.at/database/search.php], and the National Herbarium, Museum of Natural History, Oman (on request).

This volume contains a cumulative index of Latin and vernacular names of all plants included in volumes 1–4.

Over the last two decades, new phylogenetic evidence has resulted in nomenclature changes at all levels in the classification of plants. These changes, at the family, generic and specific levels need to be incorporated for the Oman flora. In addition, since the pub-

lication of the first volume of the Flora of Oman in 2003, new species, new records, and new distribution records for Oman have been made for several species. I am now working to update the checklist of the vascular plants of Oman, and on a format for an e-flora which would give easy searchable access to the identification and other information on the plants of Oman.

It has taken me over a decade to complete the descriptive flora of Oman. Throughout this time, I have had help from many colleagues and friends all over the world who have an interest in the plants of Arabia and the Middle East. I would like to thank them all, and special thanks to colleagues at Kew and Edinburgh for their continuous help. I am indebted to Botanic Garden Meise (Belgium) for agreeing to publish what was the first Catalogue of the Vascular Plants of Oman in 1992, and which expanded to the four volumes describing the plant wealth of the Sultanate of Oman.

Shahina A. Ghazanfar
Royal Botanic Gardens, Kew
January 2017

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Cronquist, A. (1981) An Integrated System of Classification of Flowering Plants. Columbia University Press.

The Angiosperm Phylogeny Group (2016). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. Bot. J. Linn. Soc. 181(1): 1–20. DOI: 10.1111/boj.12385.

Abbreviations and Transliteration

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Jim	ج	j	Ghayn	غ	gh
Ha	ح	h,	Fa	ف	f
Kha	خ	kh	Qaf	ق	q
Da	د	d	Kaf	ك	k
Dha	ذ	dh	Lam	ل	l
Ra	ر	r	Mim	م	m
Za	ز	z	Nãn	ن	n
Sin	س	s	Ha	ه	h
Shin	ش	sh	Waw	و	w
Sad	ص	S	Ya	ى	y

1. **Hydrocharitaceae**

Bibliography

den Hartog, C. (1970). The Sea grasses of the World. Verh. Konink. Nederl. Akad. Wetensch., Afd. Nat. 59 (1): 238–251.

In the APG IV (2016) classification *Najas* is included in the Hydrocharitaceae. (*Najas* is treated in its own family, Najadaceae in Cronquist's classification, followed in this Flora).

Halophila Du Petit Thouars

Eight species, widely distributed in tropical seas, extending into subtropical and warm temperate waters.

Halophila ovalis (R. Br.) Hook. f. in Fl. Tasm. 2: 45 (1860).
Synonym. Caulinia ovalis R. Br. (1810).

Description. Dioecious; submerged, marine, perennial herb, up to 5 cm. Rhizome creeping, slender with long internodes. Root single at nodes. Nodal scales 2. Leaves petiolate, paired, 10–40 × 0.5–20 mm, elliptic to oblanceolate to ovate, glabrous, base rounded, apex obtuse, margins entire; petiole 1–5 cm. Spathes with 2 overlapping bracts. Flowers solitary or paired. Male flower with perianth 3, ± 4 mm, elliptic, transparent with a dark stripe in the middle. Female flower sessile, perianth parts 3, reduced; ovary inferior, 1-locular. Fruit 3–4 mm, ovoid-globose. (Flowers and fruit not seen in Oman material).

Flowering and fruiting. Not known.

Distribution and habitat. Present in a few locations along the northern coasts including the Musandam Peninsula and Masirah Island; not uncommon, but localised. *Altitude*: mid-tide level to 10 m depth. Found off the coasts of tropical East Africa, Madagascar, Pakistan, eastwards to Australia and the western Pacific. Elsewhere in the Arabian Peninsula present along the coasts of Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 1; den Hartog, l.c., p. 242, fig. 62.

Notes. Halophila ovalis is often found growing in association with *Halodule uninervis* and is often more common than the latter species. *Halophila stipulacea* (Forssk.) Aschers. is reported in the Persian Gulf (Qatar) and the Red Sea, and is expected to occur in Oman waters. It can be distinguished by its paired linear leaves (30–60 × 1–2 mm).

2. **Potamogetonaceae**

Bibliography

Collenette, S. (1999). Wild Flowers of Saudi Arabia. NCWCD. Riyad.
Preston, C.D. (1995). Pondweeds of Great Britain and Ireland. Harley Books, London.

Symoens, J.J. (2006). Potamogetonaceae. In H. Beentje & S.A. Ghazanfar (eds), Flora of Tropical East Africa. Kew Publishing.

Potamogeton L.

Genus with 80 to 90 species; cosmopolitan.

Plant heterophyllus with lanceolate submerged leaves and elliptic floating leaves; leaves with parallel veins ..... 1. **P. nodosus**

Plants with all leaves similar; leaves cylindrical to linear, 1-veined ..... 2. **P. pectinatus**

1. ***Potamogeton nodosus*** Poir. in Lam., Encycl. Meth. Bot. Suppl. iv: 535 (1816).

Description. Perennial, rhizomatous herb, aquatic, rooted in mud. Stems up to 1 m, unbranched or with a few branches, submerged. Leaves opposite, green to reddish green, submerged and floating, petiolate with a stipule-like sheathing leaf base, keeled; leaves with parallel veins. Submerged leaves 6–8 × 2–3 cm, lanceolate, translucent, margin finely denticulate, apex acute; floating leaves broader than the submerged leaves, broadly elliptic, opaque, apex obtuse or apiculate. Flowers small, arranged in whorls in a terminal spike; spikes emerging above water. Peduncles ± 6 cm, robust. Flowers small, sessile. Perianth ± 1.5 mm. Fruit ovoid, 3–4 mm, reddish-brown, beaked.

Flowering and fruiting. January to May.

Distribution and habitat. Throughout Oman, in shallow or relatively deep calcareous, permanent freshwater pools and slow flowing streams and *aflaj*. *Altitude*: sea level to 2000 m. Africa, Asia, N & E America, temperate Europe. Elsewhere in the Arabian Peninsula present in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 2; Collenette, l.c., p. 620.

Notes. The species was not common in northern Oman, but after the construction of water reservoirs in the northern mountains, it occurs more frequently.

2. ***Potamogeton pectinatus*** L., Sp. Pl. 127 (1753).

Description. Perennial, rhizomatous herb, aquatic, rooted in mud. Stems up to 60 cm, branched, submerged, with tuberous winter-buds (turions). Leaves submerged, opposite, 4–8 cm long, linear to filiform, margin entire, apex acute; leaves 1-veined. Flowers small, up to 2 mm wide, widely spaced and arranged in spikes. Spikes interrupted in fruit, emerging above water. Fruits 3–5 mm, ovoid, beaked, clustered in groups of 4 or more.

Flowering and fruiting. January to May.

Distribution and habitat. Throughout Oman, in fresh and brackish waters, but more common in eutrophic waters. Abundant in standing and slow flowing waters, in pools in the mountains and khawrs along the coast of Dhofar. *Altitude*: 0–1000 m. Cosmopolitan. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 3; Collenette, l.c., p. 620.

3. **Ruppiaceae**

Bibliography

Dandy, J.E. (1971). Ruppiaceae. In: Rech. f. (ed.), Flora Iranica 84: 1.

Ruppia

One to seven species, in temperate and subtropical calcareous and brackish waters.

Ruppia maritima L. Sp. Pl.: 127 (1753).

Description. Submerged aquatic herb, rhizomatous, rooted. Stems slender, up to 2 m, branching profusely. Leaves alternate to subopposite, sheathing at the base, sheath membranous; lamina linear, margins entire but with minute teeth at the apex, apex acute to apiculate, Flowers 2, in a terminal spike, sessile, but with the stalk elongating in fruit. Perianth absent. Peduncle elongating in fruit. Fruit 2–3 mm, asymmetrically ovoid, finely tuberculate.

Flowering and fruiting. More or less throughout the year.

Distribution and habitat. Throughout Oman in shallow and relatively deep brackish calcareous water pools. Often found with *Najas marina* and *Potamogeton pectinatus* in the *khawrs* on the southern coast of Dhofar. *Altitude*: 0–50 m. Found in salt marshes throughout the warm tropical and temperate regions. Elsewhere in the Arabian Peninsula present in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 4.

4. **Najadaceae**

Bibliography

Triest, L. (1988). A revision of the genus *Najas* L. (Najadaceae) in the Old World. Mem. Acad. Roy. Sci. Outre-mer., Sci. Nat. nov.ser. 22: 1–172.

In Cronquist (1981) system followed here, the genus *Najas* is placed in its own family Najadaceae. In APG IV (2016) the genus in placed in the family Hydrocharitaceae, Order Alismatales.

Najas L.

About 50 species, cosmopolitan.

Stems spiny; leaves with spiny margins and midribs ..... 1. **N. marina**
Stems smooth; leaves entire or with minute teeth at the apex ..... 2. **N. graminea**

1. ***Najas marina*** L., Sp. Pl. 1015 (1753).

Description. Dioecious. Submerged annual or perennial herb of brackish water. Stems thick, coarse, up to 1 m, provided with spines. Leaves sessile, opposite or in pseudo-whorls, 10–30 × 2–5 mm, linear to linear-oblong, margins spinose-dentate, apex acute; spines also

often present on the dorsal midrib; leaf-sheath rounded. Male flowers enclosed by 2 scales. Female flowers naked; stigma 3-lobed. Fruit ellipsoid, 3 mm. (Flowers and fruit not seen in Oman material).

Flowering and fruiting. Not known.

Distribution and habitat. Throughout Oman, common in khawrs and brackish water pools. The species is abundant in some of the larger *khawrs* (Khawr Rori) on the southern coast of Dhofar. *Altitude*: sea level. Widespread in continental Europe, Asia, N Africa, Australia and S America. Elsewhere in the Arabian Peninsula possibly found in UAE and Yemen, but not confirmed. Not recorded from Saudi Arabia, but expected to occur there.

Distribution map & Illustration. 5.

Notes. The plants are reported to be eaten by camels (pers. obs.).

2. ***Najas graminea*** Delile, Descript. Egypte, Hist. Nat. 2: 282 (1813).

Description. Monoecious. Submerged annual or perennial herb. Stems up to 50 cm, without spines. Leaves sessile, opposite or in pseudo-whorls, soft and flexible, 10–30 x 1–2 mm, linear, margins smooth, apex with 2–3 teeth; leaf-sheaths deeply auriculate. Inflorescence with male and female flowers solitary or 2–4 together at the same node. Male flowers naked. Female flowers naked; stigma 2(–3)-lobed. Fruit oblong-ellipsoid, 2 mm. (Flowers and fruit not seen in Oman material).

Flowering and fruiting. Not known.

Distribution and habitat. Throughout Oman, in permanent fresh and brackish water pools. Altitude: 0–10 m. Throughout the Old World Tropics; introduced in Europe and N America. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 7.

Notes. Not as common as *Najas marina*.

Najas flexilis (Willd.) Rostk. & W.L.E.Schmidt, Fl. Sedin. 382 (1824) is reported from Dhofar, from *khawrs*, but the record is not confirmed. *N. flexis* is a northern European and northern American species and is not found in the subtropics. The record is probably a misidentification. *N. flexis* is a submerged, monoecious, perennial herb with stems up to 50 cm, without spines. Leaves sessile, opposite or in pseudo-whorls, soft and flexible, 10–30 × 1–2 mm, linear, margins minutely denticulate, apex acute; leaf-sheath rounded. Inflorescence with male and female flowers at different nodes. Male flowers enclosed by 2 scales. Female flowers naked; stigma 4-lobed. Fruit ellipsoid, about 3 mm; areoles square or hexagonal in shape. Map. 6.

5. **Zannichelliaceae**

Bibliography

Tomlinson, P.B. & Posluszny, U. (1976). Generic limits in the Zannichelliaceae (sensu Dumortier). Taxon 25: 273–279.

In APG IV (2016) Zannichelliaceae is included in the Potamogetonaceae.

Zannichellia L.

A genus of three or four species; cosmopolitan.

Zannichellia palustris L. Sp. PL. 969 (1753).

Description. Monoecious. Annual or perennial, rhizomatous herb, submerged, rooted in mud. Stems slender, up to 30 cm, unbranched or with a few branches, rooting at the nodes. Leaves opposite, sessile, 10–30 × 0.2–1.0 mm, linear, pale to bright green, margins entire, leaf base sheathing, Flowers male or female, borne on the same node. Male flowers with a single stamen; female flower with a translucent tubular perianth, pedicel short, carpels 2–5. Fruit ovoid, 3–4 mm, beaked, muricate on the dorsal and ventral edges. (Flowers and fruit not seen in Oman material).

Flowering and fruiting. Not known.

Distribution and habitat. Northern Oman, in brackish permanent water pools. Not common, and only recorded from a single pool on the Batinah. *Altitude*: 10–20 m. Cosmopolitan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

Distribution map & Illustration. 8.

Notes. Polymorphic; not as common as the other aquatic species found in Oman, and so far, not recorded from Dhofar. Species recorded from Saudi Arabia belong to *Z. palustris* subsp. *palustris*. The Oman material is not sufficient to distinguish to variety or subspecies. From the fruiting material seen, the species could be *Z. palustris* subsp. *pedicellata* (Rosén & Wahlenb.) Hook.f., Fl. Brit. India 6: 568 (1892), because of its stalked fruits and muricate dorsal and ventral edges. Confirmation of this taxon will require more flowering and fruiting material. The species can be distinguished from other brackish water species such as, *Potamogeton pectinatus* in its opposite leaves, unisexual flowers and fruit characters, and from *Najas* species (especially *N. graminea*) and *Ruppia maritima* in its entire leaves and lack of leaf-auricles.

6. **Cymodoceaceae**

Bibliography

den Hartog, C. (1970). The sea grasses of the world. Verh. Konink. Nederl. Akad. Wetensch., Afd. Nat. 59 (1): 146–186; 239–251.

Key adapted from den Hartog l.c.

1. Rhizome sympodial, ligneous; stem elongated; leaf margin minutely denticulate at apex; leaf blade shed with leaf-sheath ..... 3. **Thalassodendron**
   Rhizome monopodial, herbaceous; stem short; leaf margin entire; leaf-sheath persisting after leaf fall 2
2. Leaves flat, 3-veined ..... 1. **Halodule**
   Leaves terete ..... 2. **Syringodium**

1. **Halodule** Endl.

Six species, distributed in shallow tropical seas.

Halodule uninervis (Forssk.) Aschers., in Boiss., Fl. Or. 5: 24 (1882).
Synonym. Zostera uninervis Forsskål (1775).

Description. Rhizomatous, submerged, marine perennial herb, with 1–6 roots at each node, rooting in sand. Stem short, erect. Leaves 50–150 × 0.5–3 mm, linear to oblong, entire, apex with 2 minute teeth, 3-veined; leaf-sheath 10–30 mm, persisting longer than the leaf-blade. Flowers terminal and solitary, enclosed in a leaf similar to the others. Perianth absent. Male flower consisting of 2 anthers; female flower consisting of 2 carpels. Fruit ovoid, ± 2 mm, compressed, with a short apical beak. (Flowers and fruits not seen in Oman material).

Flowering and fruiting. Not known.

Distribution and habitat. Throughout the shallow and intertidal coastal lagoons of northern Oman, but found only at a few sites. *Altitude*: intertidal to 2 m depth. Widely distributed along the coasts of the Indian Ocean and the western Pacific, and along the eastern coasts of Africa, from the Red Sea to S Africa. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 9.

Notes. Often found growing together with *Halophila ovalis* in the waters off the Barr al Hikman Peninsula and the western side of Masirah Island. This and other coastal seagrasses are an important part of the vegetation which constitute the ecosystem for several species of marine life, including marine turtles. The species survival depends entirely on proper conservation of coastal areas and damage or improper development of the coasts will endanger the existence of this and other marine species. The name of the species is based on material collected from Yemen, Al Mukha (Mocha) by Forsskål (type specimen not located).

2. **Syringodium** Kutzing

Two species, one in the Indo-Pacific and the other in the Caribbean.

Syringodium isoetifolium (Aschers.) Dandy, J. Bot. 77: 116 (1939).
Synonym. Cymodocea isoetifolia Aschers. (1867).

Description. Rhizomatous, submerged, marine perennial herb, with 1–3 roots at each node, rooting in sand. Stem short, erect. Leaves 2–3 at each node, 50–300 × 1–2 mm, entire; leaf-sheath 10–40 mm, persisting longer than the leaf-blade. Flowers solitary and terminal, enclosed in a leaf similar to the others. Perianth absent. Male flower consisting of 2 anthers; female flower consisting of 2 carpels. Fruit obliquely ellipsoid, 3–4 mm, compressed, with a short apical beak. (Flowers and fruits not seen in Oman).

Flowering and fruiting. Not known.

Distribution and habitat. Not common in Oman; reported from the western side of Masirah and in the Arabian Gulf. *Altitude*: sub-littoral – 10 m depth. Widely distributed in tropical Indian Ocean, from the Red Sea to Madagascar, Mauritius, Seychelles extending throughout Malaysia into the western Pacific. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 10; den Hartog, l.c., Fig. 51.

Notes. The species is expected to occur in other locations off the coast of Oman and the Arabian Peninsula (e.g. Qatar).

3. **Thalassodendron** den Hartog

Two species, both widely distributed in the tropical Indo-Pacific.

Thalassodendron ciliatum (Forssk.) den Hartog, Verh. Konink. Nederl. Akad. Wetensch., Afd. Nat., 59 (1): 188 (1970) Type: Yemen, Al Mukha (Moccha), *Forsskål* (lecto. C, BM). *Synonym. Zostera ciliata* Forrsk. (1775).

Description. Rhizomatous, submerged, marine perennial herb, with 1–5 branched or unbranched roots arising from internodes, rooting in sand. Stem elongated, erect. Leaves 100–150 × 6–13 mm, linear to falcate, 17–27-veined, entire, apex denticulate; leaf-sheath 15–30 mm, falling along with the leaf-blade. Flowers solitary and terminal, enclosed by 4 leafy bracts. Perianth absent. Male flower consisting of 2 anthers; female flower consisting of 2 carpels. "Fruit" 3.5–5 cm, composed of the 2 ovaries and the fleshy inner bract, often germinating on the mother plant, free floating when ripe. (Flowers and fruit not seen in Oman).

Flowering and fruiting. Not known.

Distribution and habitat. Recorded only from the western side of Masirah Island in the Indian Ocean. *Altitude*: sub-littoral – 10 m depth. Common in the Red Sea and the western Indian Ocean, eastern Malesia, Solomon Islands and shores of Queensland. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen, UAE. Possibly also occurs in other coastal areas of the Gulf.

Distribution map & Illustration. 11; den Hartog, l.c., Fig. 52.

7. **Arecaceae** (Palmae)

Bibliography

Barrow, S.C. (1998). A Monograph of *Phoenix* L. (Palmae: Coryphoideae). *Kew Bull.* 53 (3): 513–575.

Several species of palms are cultivated in Oman, including date and coconut palm. A single species of dwarf palm is native.

Nannorrhops H. Wendl.

A single, variable species, in deserts of the Middle East (Iran, Afghanistan, Pakistan, SE Arabia).

Nannorrhops ritchieana (Griffith) Aitch., in J. Linn. Soc. 19: 187 (1882).

Vernacular names: sa'f, 'asef (Dhofārī); mish (Harsūsī); arf, zerbet, zereb (Jibbālī).

Description. Dwarf palm, shrubby, with a short trunk; branching dichotomous with branches erect or more commonly prostrate to sub-erect, usually up to 2 m, when erect reaching up to 5 m; trunk and branches covered with hardened remains of old petiole bases. Leaves fan-shaped, petiolate; petiole 15–30 cm, with small teeth on the margins, brown woolly hairy; lamina palmately divided, 30–120(–150) cm, strong and grey-green; leaflets 7–21(–40), 30–45 cm, split to more than half their length, folded. Inflorescence a lax panicle, up to 1.5 m, reaching beyond the leaves. Flowers 4–5 mm, bisexual and male on the same plant, sessile or with a short stalk; bracteoles scarious. Calyx tubular, 3-lobed, 2–3 mm, creamy-pink; petals 3, 4–5 mm, creamy-pink; stamens 6 in bisexual flowers, 9 in male flowers. Fruit (berry) 16–20 mm, subglobose, fleshy, purple-red when ripe, 1-seeded, pulp tough, edible.

Flowering and fruiting. March, April.

Distribution and habitat. Throughout Oman, in desert wadis and sandy depressions, where it grows gregariously, often forming large clumps several metres across; a few plants are present in a gorge on Jabal Akhdar (western Hajar mts.) near the road. *Altitude*: 100–300(–800) m. Arabia to northwest India. Elsewhere in the Arabian Peninsula found in UAE and SE Yemen.

Distribution map & Illustration. 12.

Notes. Strips of leaves are twisted and made into rope and twine. Formerly of great importance, and used extensively by desert Bedouins for making ropes, tackle for camels, milking bowls (with leather base) and baskets for household use. Traditonal milking bowls and baskets are still made in several bedouin households but mainly for tourists.

Cultivated species

Phoenix dactylifera L.

Vernacular names: nakhel, nakhl; tammar, tamr (fruit).

Solitary palm, dioecious, with an unbranched trunk covered with hardened leaf bases, producing suckers. Leaves pinnate, up to 1.5 m, fairly stiff and not curving, present at the apex of the trunk. Flowers in panicles.

enclosed in a greenish spathe when young. Female flowers with 3 carpels, with only one developing into the fruit. Fruit (date) ovoid, with a fleshy mesocarp, variable in colour and size, but generally 3–4 cm long with the calyx persistent at the base, 1-seeded. *Illustration*: 12a.

The date palm is cultivated throughout Oman and Arabia. Date groves are present in the foothills of the northern mountains where there is a natural supply of water. Cultivation is also present on the Batinah coast where irrigation is from aquifers. There is concern about the increasing salinity of water of the aquifers on coastal areas, which is deleterious for date palms and other agricultural products.

In date groves, the female trees are hand pollinated. There are several varieties of dates in Oman (about 40 varieties) recorded by the Ministry of Agriculture and Fisheries, based primarily on the shape, colour and size of fruit; each variety is cultivated for its unique taste and colour of fruit. Different cultivars ripen at different times of the year, supplying dates more or less throughout the year. In Oman, dates are consumed in most households with *qahwa* (coffee). Many savoury sweets are also made from dates.

Phoenix reclinata Jacq. had been reported in a gorge near Tanuf on the western Hajar mountains, but that is actually *P. dactylifera*. I have not seen any material of this species in Oman or any herbaria.

Cocos nucifera

Vernacular names: narial

Solitary palm, with an unbranched smooth trunk. Leaves pinnate, up to 2 m, present at the apex of the trunk. Inflorescence branched. Female flowers large and yielding the coconut fruit, which has a thick, fibrous mesocarp and partially fluid endosperm, the coconut or copra of commerce.

The coconut palm is cultivated along the coast in and around Salalah in Dhofar.

Species of **Washingtonia** (*W. filifera*) and **Roystonea** (*R. regia*) are cultivated on avenues, and in public and private gardens.

8. **Araceae**

Bibliography

Miller, A.G. & Morris, M. (1988). Plants of Dhofar. Diwan of Royal Cout. Oman.

Leaves 2, pedately compound; leaflets elliptic ..... 1. **Arisaema**
Leaf solitary, ovate to broadly ovate ..... 2. **Remusatia**

1. **Arisaema**

About 50 species in temperate Asia, tropical Africa and southern Asia and North America.

Arisaema flavum (Forssk.) Schott, Prodr. Syst. Aroid.: 40 (1860).
Vernacular name: ḥargyod (Jibbālī).

Description. Perennial herb, glabrous, arising from an underground tuber. Leaves 2; petiole sheaths overlapping and forming a pseudostem to 60 cm; lamina pedately divided into 7–12 leaflets; leaflets fresh green, 3–11 × 1–5 cm, elliptic, apex acute, margins entire; leaflets decreasing in size outwards with the largest in the centre. Flowers unisexual, congested on the spadix about 1.5 cm, subtended by a bract, the spathe; peduncle to 60 cm, overtopping the leaves; spathe 3–4 cm, lower part folded over to form a tube 1.5 cm, greenish with purplish stripes; upper part ovate with an acuminate tip, yellow on the outside, purplish-brown at the base on the inside. Female flowers at base of spadix, perianth absent, ovary 1-locular,

stigmas sessile; male flowers of 2–4 stamens; upper part of spadix sterile. Fruit a berry, ± 5 mm, globose-ovoid, red when ripe; berries forming a cluster.

Flowering and fruiting. September to October.

Distribution and habitat. Southern Oman, on the mist-affected plateau of the escarpment mountains, in the *Euphorbia balsamifera* zone. *Altitude*: ± 850 m. Ethiopia to western China. Elsewhere in the Arabian Peninsula found in Yemen, Saudi Arabia.

Distribution map & Illustration. 13; Miller & Morris, l.c., p. 37.

Notes. A. bottae, the second species in Arabia is endemic to Yemen and Saudi Arabia. The tubers have been recorded to be an important food source in Dhofar.

2. **Remusatia**

Two species in tropical Asia, Africa and Madagascar.

Remusatia vivipara Schott in Schott & Endlich., Melet. Bot.: 18 (1832).
Vernacular names: fóḍe (Jibbālī); foḍiy (Dhofārī Arabic).

Description. Perennial herb, glabrous, arising from an underground tuber; shoots 15–30 cm long bearing bulbils; tubers red; bulbils brown, scaly, ovoid, ± 5 mm long, scale ending in hooked prickles. Leaf solitary, petiolate; petiole to 40 cm; lamina 10–40 × 5–30 cm, ovate to broadly ovate, base cordate, apex acute to acuminate, margins entire, glossy. Flowers not known from Oman, the plant reproducing asexually by bulbils. [Flowers unisexual. Spathe 10–13 cm, leathery, lower part forming a tube, green; upper part ovate with an acuminate tip, golden-yellow. Spadix with female flowers at the base and male flowers at the tip, separated by sterile flowers in the middle; perianth absent; female flowers with ovary 1-locular, stigmas sessile; male flowers of 3–4 stamens. Fruit a cluster of berries. Description from Ara & Hassan, Bangladesh J. Plant Taxon. 12(2): 39–48, 2005].

Flowering and fruiting. Not known.

Habitat and distribution. Southern Oman, on the wet escarpment woodlands, on shaded banks of runnels and hillsides, and on leaf litter of large trees (such as *Ficus vasta*). *Altitude*: 50–300 m. Tropical Asia, Africa and Madagascar. Elsewhere in the Arabian Peninsula found in Yemen, Saudi Arabia.

Distribution map & Illustration. 14; Miller & Morris, l.c., p. 39.

Notes. The plant rarely (if at all) flowers in Arabia, and apparently rarely flowers in Africa. In Oman (and Arabia) it reproduces entirely by bulbils which are dispersed through birds, sticking to their feet by the hooked prickles of the scales. The tubers which are produced from the monsoon season to the winter months (August-December) are recorded to be a source of food for locals, eaten fresh or dried and stored for later consumption.

9. **Lemnaceae**

Bibliography

Daubs, E.H. (1965). A Monograph of Lemnaceae. Illinois Biological Monographs 34. University of Illinois Press.

Lemna L.
About nine species, cosmopolitan.

Lemna gibba L., Sp. Pl.: 970 (1753).

Description. Aquatic, free-floating; stem and leaves reduced to a ± flat thallus. Root solitary, tip covered with a root cap. Thallus yellowish green, broadly ovate, 3–5 × 2–4 mm, slightly convex, spongy below with inflated cells and airspaces; usually a large number of thalli cohering and floating together. Reproduction usually vegetative with daughter thalli buds forming laterally, 2 or 3 remaining attached with very short stipes. [Flowers unisexual, developing in a lateral cavity enclosed by a spathe. Male flowers 2, each with a single stamen; female flower 1; style short. Fruits narrowly winged above, 1–2-seeded. Description from Daubs, l.c., p. 17].

Flowering and fruiting. Not known.

Distribution and habitat. Fresh water pools in northern and southern Oman; not common. *Altitude*: 50–800 m. Widespread; North Africa, Ethiopia, South Africa and through most of the warm regions of the world. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen, UAE.

Distribution map & Illustration. 15.

Notes. A second species, *L. minor* L. may also be found in Oman. It is difficult to tell apart from *L. gibba*, but its thallus is dark green with 3 obscure veins and without large air spaces underneath.

10. **Commelinaceae**

Bibliography

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Inflorescence neither enclosed nor subtended by a spathe-like bract ..... 1. **Aneilema**
Inflorescence enclosed in or closely subtended by a spathe-like bract ..... 2. **Commelina**

1. **Aneilema** R.Br.
About 64 species, mainly tropical Africa.

Aneilema forskaolii Kunth, Enum. Pl. 4: 71 (1843) Type: Yemen, Al Hadiyah ("Hadie", "Bolghose" on field label) *Forsskål* 31, 32, 33 (syntypes C).
Synonyms. Commelina tuberosa sensu Forssk. (1775), non L. (1763); *C. paniculata* Vahl (1805), non Hill (1773).
Vernacular name: valaan (Arabic).

Description. Annual or short-lived perennial herb. Stems erect to ascending, up to 40 cm, sometimes rooting at the nodes, pubescent. Leaves alternate to spirally arranged, 2–10 × 1.5–5 cm, ovate to elliptic-lanceolate, apex acute, margins ciliate, base tapering into a short petiole forming a sheath around the stem, pilose-puberulous. Inflorescence terminal, of cymes in a lax panicle, not enclosed in spathaceous bracts; bract herbaceous. Flowers ± 1 cm wide, pedicellate, sparsely pubescent, 7–9 mm and recurved in fruit; sepals 3, 2–3 mm; petals 3, lilac to white, the upper 2 petals 4–5 mm, clawed, reflexed, the lower petal ± 3 mm, cup-shaped; stamens 6 with the upper 3 reduced to staminodes; ovary covered with glandular hairs. Capsule ± 5 mm, ovoid, yellow-green, glossy.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, in the wet escarpment mountains, at the fringes of permanent water pools or in shaded, moist locations. *Altitude*: 100–500 m. Sudan, Ethiopia, Eritrea, Djibouti. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 16.

Notes. Not common in Oman; found only on the southern mountains.

2. **Commelina** L.

About 170 species, pantropical and pan-temperate (except Europe).

Spathes solitary, scattered on the stem and not clustered at the tips of stems, not falcate .... 1. **C. forskalaei**
Spathes clustered at the tips of stems, strongly falcate ..... 2. **C. albescens**

1. ***Commelina forskalaei*** ["*forskalei*"] Vahl, Enum. Pl. 2: 172 (1805) Type: Yemen, 1763, *Forsskål* (holo. C).

Description. Annual or perennial herb, with fibrous roots. Stems branched, ascending or prostrate, up to 30 cm, rooting at the nodes. Cleistogamous flowers often present on subterranean shoots arising from the lower rooted nodes. Leaves distichous, 3–6 × ±1 cm, puberulous to pilose-puberulous or glabrous, oblong, base forming a sheath around the stem, margins undulate, apex acute to mucronate; leaf-sheath 8–12 mm, puberulous, with long white hairs at the top edge of the sheath. Inflorescence terminal, enclosed in a leafy spathe; spathes solitary, 8–10 × 5–7 mm, enclosing 1–2 flowers on short peduncles 3–7 mm; spathes folded, not falcate, puberulous to pilose-puberulous, margins fused basally. Flowers ± 1 cm wide, pedicellate; sepals 3, the inner 2 forming a keel, ± 3 mm; outer se-

pal smaller; petals 3, bright blue, the outer 4–5 mm, clawed, limb suborbicular, the lower very reduced; stamens 3, staminodes 3. Capsule ± 6 mm, ovoid, with only 1 cell dehiscent, keeled at the back. Seed brown-black, smooth, farinose.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, in the foothills and slopes of the escarpment mountains, in shaded and moist locations and near water; also in irrigated fields on the coastal plains around Salalah; common. *Altitude*: 20–250 m. NE and E Africa, S Africa, Senegal, Madagascar, India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 17.

2. ***Commelina albescens*** Hassk. in Schweinfurth, Beitr. Fl. Aethiop.: 210 (1867).

Description. Perennial herb, rhizomatous. Stems branched, erect to ascending or prostrate, up to 30 cm, greenish purple. Leaves arranged spirally or distichous, 3–10(– 15) × 1–2 cm, puberulous to pilose, linear, base forming a sheath around the stem, leaf-sheath up to 4 cm long, puberulous, ciliate above, purple-veined, apex acute. Inflorescence terminal, enclosed in a leafy spathaceous bract; spathes clustered, 10–15 × ± 10 mm, linear, enclosing 3–5 flowers; spathes folded, strongly falcate, base cordate, puberulous to pilose-puberulous, margins fused at the base. Flowers ± 8 mm wide, pedicellate; pedicel 5–6 mm; sepals 3, the inner 2 forming a keel, 4 5 mm; outer petal small, ± 2 mm; petals 3, pale blue to lilac to white (white to pale blue with age), 6 7 mm, inner two smaller than the outer, clawed, limb suborbicular; stamens 3, staminodes 3. Capsule ± 4 mm, subglobose, dorsal cell indehiscent. Seeds black with dull yellow farinose patches.

Flowering and fruiting. April, May; September, October.

Distribution and habitat. Northern and Southern Oman, in the foothills of the Hajar and Dhofar mountains, in shade near *falaj*, shaded and moist locations in wadis and gorges, and near permanent pools of water. *Altitude*: 100 2500 m. Tropical N and E Africa, India and Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 18.

Species expected to occur in Oman.

Two other species of *Commelina* are expected to occur in Oman.

Commelina erecta L., Sp. Pl. 41 (1753).

A rhizomatous perennial with decumbent stems, not rooting at nodes. Leaf sheaths usually auriculate at the apex. Spathes clustered, not or somewhat falcate, glabrous to hirsute-puberulous. Lower sepals keeled. Petals blue, the lower petal reduced and colourless. Capsule 3-celled, dorsal cell warty and indehiscent. Seeds smooth with pale yellow patches.

The species is distributed in Ethiopia, Somalia, Kenya, and in the Arabian Peninsula in Saudi Arabia and Yemen. It can be separated from *C. forskalaei* and *C. albescens* by its

clustered spathes that are not or slightly falcate. Miller & Whitcombe 2070 (E) collected from Wadi Nahiz identified as *C. erecta* subsp. *erecta* is referable to *C. albescens*.

Commelina benghalensis L., Sp. Pl. 41 (1753).
Annual or short-lived perennial herb, with branched ascending to erect stems. Cleistogamous flowers present. Leaf base narrowing into a short petiole. Leaf-sheaths with long white or coloured hairs at the mouth of the sheath. Spathes usually clustered, small (10–15 mm), folded, joined at the base. Petals blue. Capsule 3-celled. Seeds reticulate.

This species is widely distributed in the Old World Tropics, and, in the Arabian Peninsula it is recorded from Saudi Arabia and Yemen. It can be separated from C. forskalaei and C. albescens by its clustered spathes, petiolate leaves and long white or coloured hairs at the apex of leaf-sheaths.

11. **Juncaceae**

Bibliography

Kirschner, J. & Snogerup, S. (2002). Juncaceae 2: *Juncus* subg. *Juncus*. Species Plantarum: Flora of the World Part 7: 1–336.

Juncus L.
About 315 species, almost cosmopolitan, but rarer in the tropics.

Rhizome short; stems without with spiny tips; basal leaves up to 10; inflorescence ± lax, often storied; outer perianth mucronate, the inner obtuse, cucullate, margins silvery hyaline ..... 1. **J. socotranus**
Rhizome, creeping, branched; stems rigid, often with a spiny tip; basal leaves 4–5; inflorescence usually elongated; outer perianth narrowly ovate, acute to obtuse, sometimes with a small mucro; inner perianth oblong, obtuse, with margins expanded apically ..... 2. **J. rigidus**

1. ***Juncus socotranus*** (Buchenau) Snogerup, Willdenowia 23: 49 (1993).
Synonym. Juncus maritimus Lam. var. *socotranus* Buchenau (1890) – Type: Socotra, Kisher, 29 Apr 1881, *Schweinfurth* 604 (holo. K; iso. WU).
Vernacular names: rasal, mehazir (Arabic).

Description. Perennial herb, densely caespitose, up to 2 m tall, with a short rhizome; shoots intravaginal. Basal leaves up to 10, 25–110 × 0.2–0.4 cm, leaf sheaths broad, forming a thick cover around the base, basally brown. Inflorescence ± lax, often storied, of ± 200 flower heads, each with 2–4(–6)-flowers, bracteate. Lower two bracts leaf-like, pungent, with longer one 8–25(–40) cm; middle bracts small, amplexicaul, with a small pointed blade; head bracts shorter than flowers, ovate, acuminate. Perianth 6, 2–3 mm, equal or with the inner ones slightly longer; margins scarious; outer perianth mucronate, the inner obtuse, cucullate, margins silvery hyaline, not or slightly notched; bracts and perianth con-

spicuously red punctulate-striulate. Stamens 6. Capsule dark brown, trilocular, 2.5–3 mm long, exceeding the perianth, ovoid, abruptly attenuating above to forming a mucro. Seeds many, striate. (Description adapted from Kirschner & Snogerup, l.c., p. 14).

Flowering and fruiting. February to June.

Distribution and habitat. Northern Oman, including Masirah Island, at edges of semi-permanent pools, gravel wadi beds, in sandy and saline soils. *Altitude*: 10–200 m. Middle East to Iran. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Socotra.

Distribution map & Illustration. 19; Snogerup, Willdenowia 23: 50, fig. 10 (1993).

2. ***Juncus rigidus*** Desf., Fl. Atlant. 1: 312 (1800).
Synonyms. Juncus maritimus subsp. *rigidus* (Desf.) Nyman (1882); *J. maritimus* Lam. var. *arabicus* Asch. & Buchenau, in Boiss. (1882); *J. maritimus* var. *rigidus* (Desf.) Rouy (1912); *J. arabicus* (Asch. & Buchenau) Adamson (1935).
Vernacular names: rasal, rasel, mehazir (Arabic); rasel (Harsūsī).

Description. Perennial herb, up to 1.5 m, often gregarious and seemingly tufted, with a creeping branched rhizome. Stems in elongated rows, dense rigid, often with a spiny tip. Leaves 4–5, 25–110 × 0.1–0.3 cm, glabrous, acute and spinescent at the apex. Inflorescence lax, usually elongated, with up to 150 heads; heads 2–4(–6)-flowered, bracteate. Lower two bracts leaf-like, 5–25 cm, including sheath, shorter than to much exceeding the inflorescence; middle bracts small; bracts subtending heads much shorter than flowers, ovate, amplexicaul, cuspidate. Perianth 3–5 mm, margins broad, scarious; outer perianth narrowly ovate, acute to obtuse, sometimes with a small mucro; inner perianth oblong, obtuse, with margins expanded apically. Stamens 6, 2/3 to 3/4 as long as the perianth. Capsule trilocular, straw-coloured, 3.5–5 mm long, exceeding (rarely equalling) the perianth, narrowly ovoid, apex trigonous, tapering, sometimes abruptly contracted. Seeds many, striate. (Description adapted from Kirschner & Snogerup, l.c., p 16).

Flowering and fruiting. March to October.

Distribution and habitat. Throughout Oman, including the Halaniyah Islands, common by permanent fresh water or brackish pools and on fringes of streams. Usually not present at the edges of *khawrs*, but may be present on the landward side if the water is not too saline. *Altitude*: 50–200 m. Widely distributed in Africa; from Cyprus, Syria, Israel, Red Sea and the Arabian Peninsula to south Afghanistan and southern Pakistan; Turkmenistan. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 20; Snogerup, Willdenowia 23: 56, fig. 14 (1993).

Notes. The culms have been made into brooms for domestic use, but I have not seen this use in recent years.

12. Cyperaceae

Bibliography

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Kukkonen, I. (2001). Cyperaceae. In: S.I. Ali & M. Qaiser, Flora of Pakistan: 206. University of Karachi & Missouri Botanical Garden.

Notes. Terminology related to the inflorescences:

Spikelet: the basic unit of a grass or sedge flower, consisting of two outer bracts or glumes at the base and one or more florets above.

- Anthelodium; anthela: a cymose corymb inflorescence with the lateral flowers higher than the central ones.
- Glume: outer bract.

1. Aerial or emergent leaves (in aquatic plants) reduced to scarious scales at the base of stem and to tubular sheaths; submerged leaves with blades 2
   Leaves not reduced 3
2. Inflorescence a single terminal spikelet ..... 3. **Eleocharis**
   Inflorescence an anthela with pedunculate spikelets ..... 2. **Schoenoplectus**
3. Inflorescence of a single or capitate head of spikes 4
   Inflorescence a multiple spike or an anthelodium 5
4. Inflorescence of a terminal blackish capitate head of tightly overlapping spikelets; lowest or 2 involucre bracts, short and leaf-like ..... 8. **Schoenus**
   Inflorescence a single head of spikes; involucre bracts leaf-like ..... 7. **Kyllinga**
5. Glume 4–6 mm, hairy, with scarious margins; apex unevenly trifid, with mucro to 1.5 mm, ± straight ..... 1. **Bolboschoenus**
   Glumes with apex acute or obtuse, never trifid 6
6. Inflorescence formed of several groups of spikes at each stem node ..... 9. **Cladium**
   Inflorescence terminal 7
7. Style base enlarged into a stylopodium, persistent, crowning the nut ..... 4. **Fimbristylis**
   Style base not enlarged 8
8. Nut with the flat face pressed against the spike axis ..... 5. **Cyperus**
   Nut lenticular, with edge towards the spike axis ..... 6. **Pycreus**

1. **Bolboschoenus** (Aschers.) Palla

About 15 species, cosmopolitan.

Bolboschoenus maritimus (L.) Palla in Koch, Syn. Deutsch. Schweiz. Fl. ed. 3, 3: 2531 (1904).

Synonyms: *Scirpus maritimus* L. (1753); *Schoenoplectus maritimus* (L.) Lye (1971).

Vernacular names: busela (Ḥarsūsī); sa'ada (Hikmanī).

Description. Perennial, 40–100 cm, with a creeping rhizome or with stolons ending in tubers. Stem trigonous, glabrous to scabrous, grey-green. Leaves as long as the stem or

longer; leaf sheath up to 10 cm; blade up to 25 cm, flat or folded, keeled, margins entire, glabrous, greyish green. Inflorescence umbellate, of a sessile multiple spikelet of 1–4 spikes and lateral pedunculate spikes with peduncles up to 12 mm. Involucre lowest bract longer than the inflorescence. Glumes 4–6 mm, hairy, margins scarious, apex unevenly trifid, scarious with mucro to 1.5 mm, ± straight. Flowers bisexual; perianth of 4–6 bristles, persistent. Stigmas 3. Nut obovoid, trigonous, finely reticulate, dark brown, glossy.

Flowering and fruiting. May.

Distribution and habitat. Northern, central and southern Oman, on the Batinah, and coastal plain and central desert flood plain, around brackish and freshwater pools and in moist sand. *Altitude*: 50–250 m. Throughout Africa, through Arabia eastwards to Pakistan; introduced to N America. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration. 21.

2. **Schoenoplectus** H.G.L.Reichenb.
Sixty species, almost cosmopolitan in distribution.

Schoenoplectus litoralis (Schrad.) Palla, Bot. Jahrb. Syst. 10: 299 (1888).
Synonym. Scirpus litoralis Schrad. (1806).
Incl. *S. litoralis* subsp. *thermalis* (Trab.) S.S.Hooper, C.J.Saldanha & D.H. Nicolson, Fl. Hassan Distr.: 698 (1976).

Description. Aquatic rhizomatous perennial, up to 1.5 m; rhizome creeping. Stems green, erect, terete or trigonous, not leafy above base, glabrous. Submerged leaves, soft, linear, flat; emergent leaves reduced, 1– 2 cm; leaf sheath green with wide membranous sides. Ligule scarious. Inflorescence anthelodium, overtopped by the tip of the involucre bract in line with the stem; spikelets pedunculate, ovoid, pale brown. Glumes 3–4 mm, cymbiform, mucro extending beyond apex, margins widely scarious; the lowest two glumes sterile, the others fertile. Flowers bisexual; perianth bristles 4, with the upper part plumose. Stamens 3. Stigmas 2. Nuts 1– 2 mm, dark brown to black, obovoid, beaked, smooth.

Flowering and fruiting. January, February & July to September.

Distribution and habitat. Southern Oman, Dhofar, in wadis, in permanent fresh water and slightly brackish water pools. *Altitude*: 50–200 m. Temperate Eurasia to Africa and Madagascar. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 22, 23; Miller & Morris, l.c., p. 125.

Notes. Two subsp. are recognized: subsp. *litoralis* and subsp. *thermalis* (Trab.) S.S.Hooper, C.J.Saldanha & D.H.Nicolson, Fl. Hassan Distr.: 698 (1976), separated on their stems as sharply trigonous in subsp. *litoralis* or stems terete or distally trigonus in subsp. *thermalis*. Both taxa are found in Oman.

3. **Eleocharis**

About 180 species in temperate and tropical regions, mostly in the Americas.

Eleocharis geniculata (L.) Roem. & Schult., Syst. Veg. 2: 150 (1817).

Synonyms. Scirpus geniculatus L. (1753) pro parte; *Eleocharis capitata* R. Br. (1810), non *Scirpus capitatus* L.

Description. Tufted annual, to 40 cm, glabrous; roots system shallow. Culms hollow, 12–45 cm, ridged. Leaves reduced to scarious scales at the base of stem and to tubular sheaths; sheaths reddish or purple at base, greenish grey above, ending in an acute lobe with hyaline margin at apex. Inflorescence a single terminal spikelet. Inflorescence bracts greenish, covering the glumes in bud. Spikelets ovoid, 3–4. Glumes spirally arranged, imbricate; florets bisexual but the lowermost 1–2 glumes usually sterile; glumes reddish brown, brown at apex, 2 mm, rounded at apex, midrib obscure and sometimes green, margin slightly laciniate. Perianth bristles ± 7, pinkish, glabrous, longer than the nutlet. Stamens 3. Style 2-branched. Nutlet blackish purple, obovoid, smooth and shiny.

Flowering and fruiting. February/March; June to October.

Distribution and habitat. Northern and Southern Oman, in wadis with permanent water in the foothills of the western and eastern Hajar mountains, and in Dhofar in the foothills of the mountains, at edges of permanent water pools, in moist mud by brackish and sulphur pools, and in marshy areas by water seepages from *aflaj*. *Altitude*: 100–850 m. Tropical and northern Africa through the Arabian Peninsula, Iraq, Iran to India; Australasia; Americas; introduced into the Pacific. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 24.

4. **Fimbristylis** Vahl

About 300 species in tropics and warm temperate regions.

1. Glumes with short whitish hairs in upper part ..... 2. **F. ferruginea** subsp. **sieberiana**
   Glumes glabrous 2
2. Glumes obtuse without an excurrent midrib ..... 1. **F. cymosa** var. **spathacea**
   Glumes shortly mucronate ..... 3. **F. quinquangularis**

1. ***Fimbristylis cymosa*** R. Br., Prodr. Fl. Nov. Holl.: 228 (1810) var. ***spathacea*** (Roth) T.Koyama, Micronesica 1: 83 (1964).

Description. Tufted rhizomatous perennial to 70 cm. Leaves flat, up to 20 cm × 2 mm, rounded at apex; Inflorescence compound with many small pedunculate clusters of sessile spikelets; spikelets pale brown or yellowish brown. Involucre bracts short. Glumes 1.5–2 mm, ovate, apex rounded, margins wide, whitish, midrib not excurrent. Style 2-fid; style base enlarged into a stylopodium. Nutlets dark brown, obovoid, smooth or tuberculate.

Flowering and fruiting. June; October.

Distribution and habitat. Northern and southern Oman; in northern Oman in wadis in the Hajar mountains by permanent pools and streams; in Dhofar at edges of fresh, brackish or sulphur water pools, wet marshy locations in wadis, and edges of mangroves on coast. *Altitude*: 50–550 m. Pantropical. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 25.

2. ***Fimbristylis ferruginea*** (L.) Vahl, Enum. Pl. 2: 291 (1805) subsp. ***sieberiana*** (Kunth) Lye, Nordic J. Bot. 2: (1982).
Synonym. Fimbristylis sieberiana Kunth (1837).

Description. Tufted perennial to 50 cm with short rhizome, forming clumps. Stems compressed, glabrous or scabrid or with sparse obtuse teeth. Leaf sheaths membranous, greyish to brownish; lamina to 30 × 0.2 cm. Inflorescence of one sessile and few spikelets on 1–5 cm peduncles, brown or greyish. Glumes reddish brown, paler at apex, 3–4 mm, ovate, midrib excurrent, with short whitish hairs in upper part. Stamens 3. Style 2-fid; Style 2-fid; style base enlarged into a stylopodium. Nutlet brownish, obovoid-lenticular, almost smooth.

Flowering and fruiting. January; August to October.

Distribution and habitat. Northern and southern Oman, in wadis, in mud at edges of permanent water pools and *falaj*, and on wadi banks with running water. *Altitude*: 50–500 m. Tropics and subtropics of the Old World. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 26.

3. ***Fimbristylis quinquangularis*** (Vahl) Kunth, Enum. Pl. 2: 229 (1837).
Synonyms. Scirpus miliaceus L. (1759) nom. rej.; *Scirpus quinquangularis* Vahl (1805).

Description. Tufted annual, to 50 cm, with a slender rootstock, glabrous. Stems 4–5-angled. Leaves flat, 10–30 cm, with prominent midrib; ligule absent. Involucre bracts up to 3 cm long. Inflorescence lax, paniculate; spikelets sessile and with long and short peduncles, ovoid. Glumes golden brown or brown, 1–2 mm, shortly mucronate. Stamen 1. Style 3-fid; style base enlarged into a stylopodium. Nutlet white or pale yellowish brown, obovoid, obscurely trigonous, with transverse ridges, papillate.

Flowering and fruiting. September/October.

Distribution and habitat. Southern Oman, Dhofar, in moist escarpment woodland dominated by Anogeissus and in grassland. *Altitude*: 500–600 m. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration. 27.

Notes. Miller 7515, 9242, 6364 and *Miller & Whitcombe* 2078 identified as *F.* cf. *bisumbellata* (Forssk.) Bubani in Ghazanfar, Ann. Cat. Vasc. Pl. Oman 1992: p. 125, are referable to this taxon.

5. **Cyperus** L.

Some 600 species in tropical and warm regions of the World.

The classification of *Cyperus* has undergone considerable changes during the last few years. Here I follow recent treatment as in Flora East tropical Africa (2010). Nomenclature follows http://e-monocot.org/.

Good illustrations are present in Flora of Ethiopia and Eritrea 1997: Vol. 6, and photos in Collenette, 1999: Wild Flowers of Saudi Arabia, to which reference is given.

Good specimens with complete basal parts are necessary for identification.

Within *Cyperus* several subgenera are recognized of which representatives of 4 subgenera are found in Oman. These are separated by the following key (adapted from Kukkonen, Flora of Pakistan 2001: fasc. 206, p. 82):

1. Inflorescence small and compact; stigmas 2; nut lenticular ..... 3. subgen. *Juncellus* ..... (*C. laevigatus*)
   Inflorescence mostly a simple or multiple anthela; stigmas 3 2
2. Rachilla (spike axis) persistent when glumes and nuts have fallen off 3
   Rachilla disarticulating, falling with glumes and nuts ..... 4. subgen. *Mariscus* ..... (*C. amauropus*, *C. dubius*, *C. squarrosus*)
3. Spikelets arranged spikately ..... 1. subgen. *Cyperus* ..... (*C. alulatus*, *C. bulbosus*, *C. esculentus*, *C. iria*, ... *C. longus*, *C. nutans*, *C. rotundus*, *C. serotinus*)
   Spikelets arranged digitately ..... 2. subgen. *Pycnostachys* ..... (*C. arenarius*, *C. aucheri*, *C. conglomeratus*, *C. difformis*, *C. niveus*, ... *C. squarrosus*, *C. steadii*, *C. wissmannii*, *C. pseuderimicus*)

Key to the species

1. Inflorescence capitate, small and compact; involucre bract 1; stigmas 2; nut lenticular ..... 18. **C. laevigatus**
   Inflorescence mostly a simple or multiple anthela; involucre bracts more than 1; stigmas 3 2
2. Rachilla (spike axis) disarticulating, falling with glumes and nuts 3
   Rachilla (spike axis) persistent when glumes and nuts have fallen off 5
3. Inflorescence of densely arranged spikelets in an ovoid head ..... 20. **C. dubius**
   Inflorescence of loosely crowded digitate spikes or of a simple anthela 4
4. Inflorescence of simple anthela of 1–2 sessile spikelets and 1–7 stalked spikelets .... 22. **C. squarrosus**
   Inflorescence of digitate spikelets, loosely crowded ..... 19. **C. amauropus**

5. Spikelets arranged spicately 6
Spikelets arranged digitately 13
6. Perennial plant with basal bulbs ..... 1. **C. bulbosus**
Basal bulbs absent 7
7. Perennial plant with stolons covered with brown scales, ending in small blackish tubers ..... 2. **C. esculentus**
Plants without tubers at end of stolons 8
8. Clump-forming plant with stolons connecting clumps; roots with nodules, nodules white turning brown ..... 3. **C. rotundus**
Roots not bearing nodules 9
9. Glumes rounded at apex (obtuse) 10
Glumes mucronate, acute or acuminate at apex 12
10. Leaf blade with brown markings, margins smooth; glumes yellowish brown ..... 6. **C. alulatus**
Leaf blade without brown markings, margins smooth, glabrous or scabrid at apex; glumes greyish green or brownish 11
11. Spikelets in loose clusters, yellowish brown, slightly flattened; rachilla straight, or very slightly zig zag ..... 7. **C. iria**
Spikelets in dense clusters, greyish green; rachilla straight ..... 8. **C. serotinus** var. **serotinus**
12. Inflorescence a compound anthela, often branched, terminated by a solitary spike; glumes reddish brown, keel pale green, not excurrent, margins hyaline, 1–3-veined ..... 4. **C. longus**
Inflorescence a simple to compound anthela, spikelets crowded, sessile and at the end of primary branches; glumes greyish green, concave with a reddish brown keel, strongly excurrent, prominent reddish lateral veins on either side ..... 5. **Cyperus nutans** var. **eleusinoides**
13. Leaf sheaths rigid, distinctly brownish veined, becoming fibrous with age; leaf blade stiff, strongly concave; involucre bracts leaf-like, rigid, 1–2, one often as continuation of stem ..... 9. **C. arenarius**
Leaf sheaths, leaves and involucre bracts not stiff or rigid 14
14. Roots densely tomentose 15
Roots not tomentose 16
15. Leaves sometimes rigid and curling; inflorescence simple or cluster of spikelets or a globose head, 1–4 cm across; spikelets greyish green to greyish brown; glumes pale brown, concave, ovate, margins scarious, lateral veins 3–5 .. 10. **C. conglomeratus**
Leaves, flat, ± spreading; inflorescence a loose cluster of spikelets; spikelets brownish green ..... 11. **C. aucheri**
16. Glumes obovate to rounded, 0.5–1 mm, keel green, winged; glumes spreading when mature and showing nutlets ..... 14. **C. difformis**
Glumes without winged keel, not spreading when mature 17

17. Leaf blade linear, 1–2 mm wide, margins inrolled, scabrid on margins 18
    Leaf blade flat 19
18. Involucre bracts 2–3, leaf-like, channelled or folded; glumes pale grey-green to white, acuminate ..... 13. **C. niveus**
    Involucre bracts 3; glumes with wide hyaline margins, acuminate with recurved mucro, slightly keeled, with obscure lateral veins ..... 12. **C. jeminicus**
19. Inflorescence a simple anthela 20
    Inflorescence capitate, spikelets in one or more clusters 21
20. Tufted annual, 7–15 cm; spikelets in dense spikes, sessile and at the end of primary branches; glumes yellowish to reddish brown, apex strongly mucronate, mucro to 1 mm, straight; keel green, strongly excurrent with 3–4 veins on either side ..... 16. **C. wissmannii**
    Tufted perennial, up to 40 cm tall; spikelets linear-lanceolate, compressed; glumes whitish to grey-green, acuminate with straight or recurved mucro; keel not prominent, not excurrent ..... 21. **C. pseuderemicus**
21. Leaf blade 1 mm wide, channelled, margins smooth; glumes with mid-vein green, mid vein and one vein on either side extending into a recurved mucro; lateral veins prominent ..... 17. **C. steadii**
    Leaf blade 1–2 mm wide, flat, often curving at apex, scabrid on margins and primary vein; glumes with 5–8 veins on either side of the keel, acute to mucronate and recurved, scabrid ..... 15. **C. rubicundus**

1. ***Cyperus bulbosus*** Vahl in Enum. Pl. Obs. 2: 342 (1805).
Vernacular name: gusgus (Harsūsī).

Description. Perennial with basal bulbs. Culms 10–15 cm, trigonous, arising from the bulb, glabrous. Leaves many, longer than the culms; leaf sheath greyish brown to green, to 5 cm and forming a basal part of the culm; leaf blade linear, 2–3 mm wide, slightly scabrid on the margins, acuminate. Involucre bracts leaf-like, spreading, 3–6, lowermost 5–10 cm. Inflorescence a simple anthela, primary branches 3–5; spikelets in loose clusters on elongated axis and at the end of primary branches; spikelets reddish brown, linear-lanceolate. Glumes dark reddish brown with wide hyaline margins, ovate, with lateral veins on either side, acute, slightly excurrent. Stamens 3. Nutlet brown, oblong-ellipsoid, papillose.

Flowering and fruiting. March to May in northern Oman; September/October in Dhofar.

Distribution and habitat. Northern and southern Oman, in moist places, in wadi beds, in drying ground in desert, and in crevices of wet and shaded cliffs. *Altitude*: 50–500 m. Widespread from Africa to India and Australia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration 28; Fl. Ethiop. & Eritr., l.c., p. 452, f. 212.91.

2. ***Cyperus esculentus*** L., Sp. Pl.: 45 (1753).

Description. Perennial, with stolons covered with brown scales, ending in a small (3–5 mm) blackish tuber. Culms to 50 cm, trigonous, glabrous. Leaves as long as or longer than culms, crowded near the base; leaf sheath pale green; leaf blade linear, flat, with 2 main veins next to primary vein, distinct, apex acuminate, glabrous to minutely scabrid on margins and veins. Involucre bracts 2–6, leaf-like, spreading. Inflorescence simple or compound; spikelets in loose clusters on elongated axis, sessile and at the end of primary and secondary branches, linear-lanceolate. Glumes yellowish-brown, ovate to obovate, hyaline, with 3–4 distinct veins on each side of the keel, glabrous; keel green to reddish-brown. Stamens 3. Nutlet shiny greyish brown, ellipsoid, trigonous.

Flowering and fruiting. August/September.

Distribution and habitat. Northern and Southern Oman, in moist locations, in wadis, and at edges of shrubland. *Altitude*: 50–700 m. Widespread in Africa; southern Europe, Turkey to Iran and Pakistan. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 29; Fl. Ethiop. & Eritr., l.c., p. 451, f. 212.90.

Notes. Miller 7199 from Dhofar is referable to this taxon.

3. ***Cyperus rotundus*** L. Sp. Pl.: 45 (1753).

Synonyms. Cyperus tuberosus Rottb. (1773); *C. retzii* Nees (1834); *C. nubicus* C.B.Clarke (1901); *C. bifax* C.B. Clarke (1908); *C. rotundus* L. subsp. *tuberosus* (Rottb.) Kük. (1936); *C. rotundus* L. subsp. *retzii* (Nees) Kük. (1936).

Description. Perennial, not forming clumps; culms 10–100 cm, few, trigonous, green, glabrous; stolons covered with scales and connecting clumps; roots with nodules, white turning brown. Leaves glossy green; leaf sheath green-reddish brown; leaf blade linear, 10–40 × 0.2–0.8 cm, scabrid on margins and major veins, attenuate. Involucre bracts leaf-like, 1–5, erect or spreading. Inflorescence a simple to compound anthela; primary branches 1–8. Spikelets in dense clusters, 3–15 per cluster, yellow-brown to dark brown, linear-lanceolate, 6–70 mm, slightly flattened; rachilla straight; bracts reddish brown, ovate, ± 3 mm, apex obtuse, keel green, glabrous or slightly scabrid. Stamens 3, yellow. Style trifid, white. Nutlet dark brown, obovoid, trigonous, minutely papillose.

Flowering and fruiting. June to October.

Distribution and habitat. Throughout Oman, in swamps, wet gravel in wadi beds, by edges of permanent pools, and cultivated fields. *Altitude*: 200–1000 m. Widespread in Africa; India. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 30; Collenette, l.c., p. 282.

Notes. Edmondson 3297 (*Cyperus* indet in Ghazanfar, Ann. Cat. Vasc. Pl. Oman 1992: 125) is referable to this taxon. Recorded to be palatable to cattle in Dhofar.

4. ***Cyperus longus*** L., Sp. Pl.: 45 (1753).
Synonyms. Pycreus longus (L.) Hayek (1932); *Cyperus fenzelianus* Steud. (1854); *C. longus* L. var. *pallidus* Boeckeler (1870).
Vernacular name: sardot (Arabic).

Description. Erect perennial with rhizomes; culms few, clustered, to 50 cm, trigonous, glabrous, reddish brown. Leaves as long as or shorter than the inflorescence; leaf sheath pale to dark reddish-brown; leaf blade linear, flat, with a distinct midrib, scabrid. Involucre bracts leaf-like, 3–5, erect or spreading, lowermost 7–60 mm, scabrid. Inflorescence a compound anthela, branches clustered, often branched, terminated by a solitary spike. Spikelets oblong to lanceolate; rachilla straight. Glumes reddish brown, with a pale green keel, ± 2 mm, ovate-lanceolate, with hyaline margins, 1–3-veined, glabrous. Stamens 3. Nutlet dark brown to black, obovoid, minutely punctate.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in wet woodland. Altitude: 100–650 m. Widespread in Africa, and from Europe to the Indian subcontinent. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 31; Fl. Ethiop. & Eritr., l.c., p 450, f. 212.88.

Notes. A polymorphic species very similar to *C. rotundus*, and according to Haines & Lye (Sedges & Rushes of East Africa: 189, fig. 369, 1983) differs from *C. rotundus* only in the slightly swollen stem base and somewhat shorter glumes. *Miller* 7199 (*Cyperus* indet. in Ghazanfar 1992: 125) is referable to this taxon.

5. ***Cyperus nutans*** Vahl, Enum. Pl. 2: 363 (1806) var. ***eleusinoides*** (Kunth) R.W.Haines, Bot. Bihar Orissa 5: 898 (1924).
Synonyms. Cyperus eleusinoides Kunth (1837); *C. nutans* Vahl subsp. *eleusinoides* (Kunth) T.Koyama (1977).

Description. Perennial, with a thick rhizome. Culms few, 40–100 cm long, trigonous, glabrous. Leaves up to 60 cm long; leaf sheath pale green to yellowish green; leaf blade linear, flat, scabrid on margins and primary vein, at least near apex, apex acuminate. Involucre bracts leaf-like, spreading, 3–6. Inflorescence a simple to compound anthela, primary branches 4–7; spikelets greyish green, in crowded spikes, sessile and at the end of primary branches; rachilla straight. Glumes greyish green, concave with a reddish brown keel, strongly excurrent, with prominent reddish lateral veins on either side, apex mucronate. Stamens 3. Nutlet dark brown, obovoid-oblong, trigonous, minutely papillose.

Flowering and fruiting. September to December.

Distribution and habitat. Northern and southern Oman, in wadis, gravelly wadi beds and in mud by permanent pools. *Altitude*: 60–350 m. West, tropical East and North Africa; Palestine to Afghanistan. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 32; Fl. Ethiop. & Eritr., l.c., p. 454, f. 212.95.

6. ***Cyperus alulatus*** J.Kern in Reinwardtia 1: 464 (1952).

Description. Tufted annual; culms 15–40 cm, trigonous, glabrous; roots numerous, reddish brown. Leaves as long as or exceeding stems; leaf sheath yellowish; leaf blade with brown dots, linear, 15–20 × 0.4–0.5 cm, flat or slightly keeled, apex acute, margins smooth. Involucre bracts leaf-like, 1–5, erect or spreading, 3–26 × 2–7 mm. Inflorescence a simple to compound anthela; primary branches 6–10. Spikelets in dense clusters, 5–15 per cluster, yellowish brown to dark reddish brown, slightly flattened; rachilla straight, remaining attached to rachis while lower glumes and nutlets are shed; glumes yellowish brown, ovate, apex obtuse, glabrous or slightly scabrid. Stamens 3, yellow. Style trifid, white. Nutlet dark brown to black, obovoid, trigonous, minutely papillose.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, in grassland and moist locations. *Altitude*: 400–800 m. Afghanistan to Nepal and central India. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 33.

Notes. Fairly distinct in its flattened patent-erect cluster of spikelets.

7. ***Cyperus iria*** L., Sp. Pl.: 45 (1753).
Synonym. Cyperus iria L. var. *paniciformis* C.B.Clarke (1893).
Vernacular name: hamtok (Jibbālī).

Description. Erect annual; culms single, to 40 cm, trigonous, glabrous; roots numerous, reddish brown. Leaves as long as stems; leaf sheath purplish; leaf blade linear, 8–20 cm, flat or slightly keeled, apex acute, margins smooth, glabrous or scabrid at apex. Involucral bracts leaf-like, 2–3(–5), erect or spreading, 3–26 × 2–7 mm. Inflorescence a simple to compound anthela. Spikelets in loose clusters, yellowish brown, slightly flattened; rachilla straight, or very slightly zig-zag, remaining attached to rachis while lower glumes and nutlets are shed. Glumes greyish green, ovate, apex obtuse, glabrous or slightly scabrid. Nutlet dark brown to black, obovoid, trigonous, minutely papillose.

Flowering and fruiting. September/October.

Distribution and habitat. Southern Oman, Dhofar, in grassland, near small pools of water. *Altitude*: 500–1000 m. Widespread in tropical Africa, Malaysia, Australia; from Arabia to China; introduced in North and South America. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 34; Fl. Ethiop. & Eritr., l.c., p. 453, f. 212.94.

Notes. Oman material is smaller and more delicate than material from Pakistan, Iraq or India.

8. ***Cyperus serotinus*** Rottb., Descr. Icon. Rar. Pl.: 31 (1773) var. ***serotinus***.
Synonym. Cyperus glaber Vill. (1787) *nom. illeg.*

Description. Erect perennial with rhizomes; culms clustered, to 50 cm, trigonous, glabrous; roots numerous, reddish brown. Lower part of culms and leaf sheaths yellowish brown. Leaves as long as or exceeding the inflorescence; leaf blade linear, flat, scabrid on margins. Involucral bracts leaf-like, 3–5, erect or spreading, 15–60 × 2–7 mm, scabrid. Inflorescence a compound anthela. Spikelets in dense clusters, greyish green, lanceolate or oblong-lanceolate, with 8-30 flowers; rachilla straight. Glumes brownish, with a keeled green centre, ± 2 mm, broadly ovate with hyaline margins, apex obtuse, glabrous. Stamens 3. Nutlet dark brown to black, obovoid.

Flowering and fruiting. February.

Distribution and habitat. Northern Oman, in moist wadi. *Altitude*: ± 150 m. Widespread from temperate Eurasia to Indo-China. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 35.

Notes. A single collection from Ruwi in Oman, near the Al Bustan Hotel, possibly introduced with soil and other exotic plants.

9. ***Cyperus arenarius*** Retz., Observ. Bot. 4: 9 (1786).
Synonym. Cyperus persicus Boiss. & Hohen. (1854).

Description. Perennial with long creeping rhizomes; roots thin. Culms 8–25 cm, almost terete, glabrous. Leaves ± equaling the culms; leaf sheaths rigid, distinctly brownish veined, becoming fibrous with age; leaf blade stiff, linear, 1 mm wide, strongly concave, slightly scabrid on the margins, apex flat, acute or truncate. Involucre bracts leaf-like, rigid, 1–2, one often as continuation of stem. Inflorescence capitate with up to 20 spikelets; spikelets dark brown, ovoid, compressed. Glumes pale brown, concave, ovate, margins scarious, lateral veins obscure. Stamens 3. Nutlet dark brown, obovoid, compressed, smooth, glossy.

Flowering and fruiting. February, April; October.

Distribution and habitat. Northern Oman, including Masirah Island, in the eastern desert on mainland, on coastal dunes and in small brackish sandy depressions. *Altitude*: ± 20 m. From the coasts of the Persian Gulf to the western and eastern coasts of India and Sri Lanka. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE.

Distribution map & Illustration. 36.

10. ***Cyperus conglomeratus*** Rottb., Descr. Icon. Rar. Pl.: 21 (1773) – Type: Arabia, *Forsskål*, s.n. (lecto. C).
Vernacular names: a'shayish (Arabic); hashaysh, gusgus, giseas, hamtok (Harsūsī).

Description. Tufted perennial; roots with a tomentose sheath, usually with sand adhering. Culms 10–50 cm, almost terete, glabrous. Leaves ± equaling the culms, often curving, sometimes rigid with involute margins; leaf sheaths hard, brownish or reddish, becoming fibrous with age; leaf blade linear, 1–2 mm wide, slightly scabrid on the margins, acute. In-

volucre bracts leaf-like. Inflorescence simple or cluster of spikes or a globose head, 1–4 cm across; spikelets greyish green to greyish brown, ovoid, compressed. Glumes pale brown, concave, ovate, margins scarious, lateral veins 3–5. Stamens 3. Nutlet dark brown to black, obovoid, surface finely reticulate.

Flowering and fruiting. February to October.

Distribution and habitat. Throughout Oman, including Masirah and Halaniyah Islands, in sand at edge of desert, coastal dunes, gravelly and sandy wadi banks, crevices of rocks; common and usually abundant. *Altitude*: 20–2000 m. Widespread in dry and hot parts of Africa and western Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 37; Fl. Ethiop. & Eritr., l.c., p. 463, f. 212.112.

Notes. One of the most common sedges in Oman; two subspecies are recognized:

Plants 10–40 cm; stem terete; leaf sheaths 4-12 cm, reddish; inflorescence a small anthelodium, globose head or multiple spikes ..... a. subsp. *conglomeratus*
Plants up to 50 cm; stem obtusely trigonous; leaf sheaths up to 2 cm, yellow to greyish brown; inflorescence a cluster of spikes ..... b. subsp. *curvulus*

I have found it difficult to separate the two subspecies absolutely. Plants growing in coastal areas, especially the Bar al Hikman Peninsula and those on the Hajar mountains, especially at the summit are typically subsp. *conglomeratus*, but there is considerable overlap of characteristics between the two subspecies in others areas in Oman. *C. conglomeratus* is a variable species found throughout the Arabian Peninsula, in different habitats and has a wide altitudinal range. It is recorded to be grazed by camels, but I have seen that it is grazed only when there are no other palatable species present, or only the fresh shoots are grazed, otherwise largely left alone.

11. ***Cyperus aucheri*** Jaub. & Spach, Ill. Pl. Orient. 2: 1, t. 101 (1844).

Description. Tufted perennial; roots tomentose, often with grains of sand adhering. Culms 13–80 cm, almost terete, glabrous. Leaves grey-green, ± equaling or shorter than culms, weak and spreading; leaf sheaths greyish green to yellowish green; leaf blade linear, 1–2 mm wide, flat or involute, slightly scabrid on the margins, acute. Involucre bracts leaf-like. Inflorescence a loose cluster of spikes; spikelets brownish green, ± 2 cm, ovoid, compressed; rachilla to 4 cm. Glumes yellowish brown, concave, ovate, margins scarious. Stamens 3. Nutlet dark brown, obovoid, surface finely reticulate.

Flowering and fruiting. January; September, but also at other times of the year.

Distribution and habitat. Throughout Oman, in sand or gravel overlain by sand, on low dunes, and in moderately saline soils. *Altitude*: 100–450 m. Northeast tropical Africa. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration. 38.

Notes. A common sedge found on sand dunes, often going under the name of and identified as *C. conglomeratus*.

12. ***Cyperus jeminicus*** Rottb., Descr. Icon. Rar. Pl.: 25 (1773).

Description. Tufted perennial, up to 30 cm tall; roots with sand grains adhering; culms grey-green, tufted, glabrous. Leaves grey-green shorter or as long as than culms; leaf sheath brown to greenish brown, loose; leaf blade linear, 1–2 mm wide, margins inrolled, acute to truncate. Involucre bracts 3, leaf-like. Inflorescence a single globose cluster of spikelets, brownish green; spikelets linear-lanceolate, compressed. Glumes brown with wide hyaline margins, distichous, elliptic, acuminate with recurved mucro, slightly keeled, with obscure lateral veins.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, on dry rocky coastal limestone cliffs, depressions, and in moist sandy soil on beach with *Ipomoea pes-caprae*. *Altitude*: 1–300 m. Cape Verde, western Africa and Madagascar; India. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, Yemen.

Distribution map & Illustration. 39; Collenette, l.c., p. 280.

13. ***Cyperus niveus*** Retz., Observ. Bot. 5: 12 (1788).

Description. Tufted perennial, up to 15 cm tall; culms grey-green, tufted, terete to upper part trigonous, glabrous. Leaves grey-green shorter or as long as than culms; leaf sheath brown to greyish brown, loose; leaf blade linear, 1–2 mm wide, margins inrolled, scabrid on margins, acute. Involucre bracts 2–3, leaf-like, channeled or folded as leaves. Inflorescence a single globose cluster of spikelets, whitish or yellowish brown; spikelets to 20 per head, crowded, lanceolate, compressed. Glumes pale grey-green to white, tightly distichous, elliptic, acuminate, slightly keeled, with obscure lateral veins. Stamens 3. Nutlet dark brown to black, shiny, obovoid, obscurely papillose.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, in rocky wadis, in moist pockets of soil, crevices of rocks. *Altitude*: 95 m. Tropical East Africa, and from eastern Iran to Myanmar. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 40; Collenette, l.c., p. 282.

Notes. A single collection from Jebel Qamar, from Wadi Aful, but probably under-collected.

14. ***Cyperus difformis*** L., Cent. Pl. 2: 6 (1756).

Description. Perennial or annual. Culms to 50 cm, trigonous, glabrous. Longer than the culms overtopping the inflorescence; leaf sheath green to reddish brown; leaf blade linear, flat, glabrous to scabrid on primary veins and margins, apex acuminate. Involucre bracts

leaf-like, spreading, 2–4, 8–35 cm. Inflorescence simple to compound; primary branches 0–14; spikelets in dense clusters, sessile or at the end of primary and secondary branches, 10–many per cluster, ovoid. Glumes yellowish brown to reddish brown, obovate to rounded, 0.5–1 mm, keel green, winged, spreading when mature and showing nutlet. Stamens 2. Nutlet pale yellowish brown, ellipsoid, slightly exceeding the glume, smooth or minutely papillose.

Flowering and fruiting. October.

Distribution and habitat. Southern Oman, Dhofar, in mud on fringes of permanent pools. *Altitude*: ± 200 m. Widespread in Africa, southeast Asia and the Pacific. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration. 41; Fl. Ethiop. & Eritr., l.c., p. 452, f. 212.64.

Notes. A single collection from Jebal Qara, from the Wadi Darbat pools, but perhaps under-collected.

15. ***Cyperus rubicundus*** Vahl in Enum. Pl. 2: 308 (1806).

Description. Tussock forming annual, 8–30 cm, with a small root system, the whole plant reddish-brown. Culms tufted, slender 4–15 cm, trigonous, slightly scabrid below the inflorescence. Leaves as long as or shorter than the culms; leaf sheath greyish brown 1–4 cm long; leaf blade linear, often curving at apex, flat, 1–2 mm wide, apex acute to acuminate, scabrid on margins and primary vein. Involucre bracts leaf-like, spreading, 1–2(–3), lowermost 1–5 cm long. Inflorescence capitate, spikelets in digitate clusters, squarrose, lanceolate; rachilla straight. Glumes reddish brown, ovate, 2.5–4 mm, with 5–8 veins on either side of the keel, acute to mucronate and recurved, scabrid. Stamens 2–3. Stigma unbranched, or shallowly branched with 3 stigmas. Nutlet greyish-brown, obovoid, triquetrous, minutely papillose.

Flowering and fruiting. September/October.

Distribution and habitat. Northern and Southern Oman; in northern Oman in the foothills of the western Hajar mountains; in Dhofar, in the escarpment woodland, at edges of sandy watercourses. *Altitude*: 600–900 m. Africa to India; north Australia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 42; Fl. Ethiop. & Eritr., l.c., p. 465, f. 212.114; Collenette, l.c., p. 283.

16. ***Cyperus wissmannii*** O.Schwartz, Mitt. Inst. Allg. Bot. Hamburg 10: 341 (1939).

Description. Small tufted annual, 7–15 cm with a small root system; culms solitary or few, tufted, 5–10 cm, trigonous, ± glabrous. Leaves shorter than culms, not reaching to the inflorescence, soft and curling; leaf sheath greenish brown; leaf blade linear, flat, 1–4 mm wide, slightly scabrid to glabrous, acuminate. Involucre bracts leaf-like, erect to spreading, 2–5. Inflorescence a simple anthela, primary branches 1–7; spikelets in dense spikes, sessile and

at the end of primary branches, crowded, linear, 2–7 mm long, flattened, squarrose with straight glume-apices. Glumes yellowish to reddish brown, elliptic, mucro to 1 mm, keel green, strongly excurrent with 3–4 veins on either side, apex strongly mucronate, mucro straight. Stamen 1. Nutlet dark grey-brown, narrowly oblong to obovoid, trigonous, minutely papillose, disarticulating at its base but held by persistent glume so that it falls with the spikelet.

Flowering and fruiting. April, May.

Distribution and habitat. Northern Oman, in the Hajar mountains, in soil on rocky slopes. *Altitude*: 1200–1300 m. Northeast tropical Africa. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 43.

Notes. Very similar to *C. squarrosus* and possibly conspecific with it. Recorded only a couple of times from Wadi Serin in the Eastern Hajar and Jabal Akhdar in the Western Hajar mountains. Found at relatively high altitudes both in Oman and Yemen.

17. ***Cyperus steadii*** Kükenthal, Repert. Spec. Nov. Regni Veg. 29: 199 (1931).

Description. Small, tufted annual, to 15 cm. Culms weak, almost terete, glabrous. Leaves longer than the culms; leaf sheaths grey-green to yellowish, soft; leaf blade linear, 1 mm wide, channeled, margins smooth, apex narrowing to an acute tip. Involucre bracts leaf-like, 1–2, flexuous. Inflorescence simple of one or more cluster(s) of spikelets; spikelets spreading, reddish brown, ovoid, compressed. Glumes reddish brown, keeled, ovate, margins scarious; mid-vein green, mid vein and one vein on either side extending into a recurved mucro; lateral veins prominent. Stamens 3. Nutlet dark brown, obovoid, trigonous, finely papillose.

Flowering and fruiting. May.

Distribution and habitat. Central Oman, Jiddat al Harasis, in sandy and gravelly depressions; recorded to be abundant after rain. *Altitude*: 100–150 m. Also Iran and Pakistan. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 44.

18. ***Cyperus laevigatus*** L., Mant. Pl. 2: 179 (1771).
Synonyms. Pycreus laevigatus (L.) Nees (1836); *Juncellus laevigatus* (L.) C.B. Clarke (1893).

Description. Perennial, up to 50 cm tall, with a creeping rhizome; culms tufted or spaced along the rhizome, terete to trigonous, sometimes triquetrous, glabrous, the base covered with short scales. Leaves grey-green, shorter than culms; leaf sheath pale to dark purple brown, loose; leaf blade sometimes absent but when present linear, almost culm-like, margins inrolled, scabrid on margin but appears glabrous as margins are inrolled, acute. Involucre bract (1) one, leaf-like, straight, continuing in the direction of the culm, making

the inflorescence appear lateral. Inflorescence capitate; spikelets 1 to 20 per head, loosely crowded, linear to lanceolate; rachilla straight to curved. Glumes pale grey-green to yellowish with reddish brown dots, broadly elliptic, acute. Stamens 2. Style with 2 long linear branches. Nutlet grey to brown, often shiny, obovoid to ellipsoid, flat on one side, rounded on the other, smooth.

Flowering and fruiting. September/October.

Distribution and habitat. Northern and Southern Oman, in moist saline mud, and at edges of brackish water. *Altitude*: 100–350 m. Tropical and subtropical regions of the world. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, Yemen.

Distribution map & Illustration. 45; Fl. Ethiop. & Eritr., l.c., p. 459, f. 212.104.

Notes. Gallagher 6897 (*Cyperus* indet. in Ghazanfar, Ann. Cat. Vasc. Pl. Oman 1992:) is referable to this taxon.

19. ***Cyperus amauropus*** Steud., Syn. Pl. Glumac. 2: 33 (1854).
Synonyms. Cyperus leptophyllus (C.B.Clarke) Hochst. ex Kük. (1936); *Mariscus amauropus* (Steud.) Cufod. (1970).

Description. Small tufted perennial, to 15 cm with swollen stem bases. Leaves greyish to yellowish green, shorter than culms; leaf sheath brownish; leaf blade linear, acute, glabrous. Involucre bract 1–2, leaf-like, straight to curling. Inflorescence of digitate spikelets, loosely crowded, lanceolate-linear; rachilla straight. Glumes pale grey-green, broadly elliptic, acute, keel extending as a short mucro. Nutlet brown, obovoid to ellipsoid, densely papillose.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, in moist mud at edges of permanent water pool. *Altitude*: ± 1200 m. Eastern Africa (Zambia) to Eritrea. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 46; Fl. Ethiop. & Eritr., l.c., p. 466, f. 212.115.

Notes. A single collection from Jebel Qamar, west of Mughsayl, on hills dominated by *Dracaena serrulata*, *Acacia etbaica* and *Commiphora* spp., but possibly under-collected. Recorded to be locally abundant in south Yemen at similar altitudes. *Miller & Nyberg* M.9342 from Dhofar (*Cyperus* indet. in Ghazanfar 1992: 125) is referable to this taxon.

20. ***Cyperus dubius*** Rottb., Descr. Icon. Rar. Pl.: 20 (1773).
Synonym. Mariscus dubius (Rottb.) Kük. ex G.E.C.Fischer (1931).

Description. Tufted perennial to 30 cm with swollen stem bases, covered with remains of old leaf sheaths. Leaves grey-green, as long as the culms; leaf sheath brownish; leaf blade linear, acute, ± scabird on margins. Involucre bract 1–2, leaf-like. Inflorescence of densely arranged spikelets in an ovoid head; spikelets lanceolate, greenish; rachilla straight.

Glumes pale grey-green, broadly elliptic, with obscure lateral veins, acute. Nutlet brown, obovoid, papillose.

Flowering and fruiting. August.

Distribution and habitat. Southern Oman, on the escarpment mountains, in cracks of large rocks on edge of a permanent water pool. *Altitude*: ± 150 m. Tropical and south Africa through India to tropical Asia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 47.

Notes. A single collection from Wadi Hinna growing in cracks on large boulders.

21. ***Cyperus pseuderemicus*** Kukkonen & Väre, Ann. Bot. Fenn. 42: 474 (2005).

Description. Tufted perennial, up to 40 cm tall, with small roots; culms grey-green, glabrous. Leaves grey-green as long as and longer than culms; leaf sheath brown to greenish brown, loose; leaf blade linear, 1–2 mm wide, margins inrolled, acute, scabrid on margins. Involucre bracts with margins scabrid. Inflorescence a simple anthela with grey-green spikelets; spikelets linear-lanceolate, compressed. Glumes whitish to grey-green, distichous, elliptic, acuminate with straight or recurved mucro, slightly keeled, margins hyaline, with brownish lateral veins.

Flowering and fruiting. September.

Distribution and habitat. Central Oman, in gravel plain with shallow wadi, in sand on wadi bank. *Altitude*: ± 90 m. Endemic to the Arabian Peninsula; elsewhere found in Saudi Arabia.

Distribution map & Illustration. 48.

Notes. A single collection from the central desert close to the Saudi Arabian desert.

22. ***Cyperus squarrosus*** L., Cent. Pl. II: 6 (1756).
Synonym. Mariscus squarrosus (L.) C.B.Clarke (1893).

Description. Annual with a small root system; culms crowded and tufted, 5–20 cm, trigonous, almost glabrous. Leaves shorter or about as long as the culms; leaf sheath greenish; leaf blade linear, flat, 1–4 mm wide, slightly scabrid to glabrous, acuminate. Involucre bracts leaf-like, 2–5, erect to spreading. Inflorescence a simple anthela, primary branches 1–7; spikelets in dense spikes, sessile and at the end of primary branches, flattened, squarrose with recurved glume-apices, 5–15-flowered. Glumes reddish-brown, tipped green, elliptic with 1 mm long recurved mucro, keel green, lateral veins 3–4 veins on either side. Stamen 1. Nutlet dark grey, narrowly oblong to obovoid, trigonous, minutely papillose, disarticulating at its base but held by persistent glume so that it falls with the spikelet.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, in wet woodland and grassland, moist stony wadi beds and near marshy areas near permanent pools. *Altitude*: 500–900 m. Tropi-

cal and subtropical regions of Africa and Asia to North America. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 49; Fl. Ethiop. & Eritr., l.c., p. 462, f. 212.109; Collenette, l.c., p. 283.

6. **Pycreus** P. Beauv.
About 118 species, cosmopolitan.

Pycreus dwarkensis (K.C.Sahni & H.B.Naithani) S.S.Hooper, Kew Bull. 40: 467 (1985).
Synonym. Cyperus dwarkensis Sahni & Naithani (1976).

Description. Tufted annual, up to 20 cm, glabrous. Stems trigonous above. Leaves longer than stems; leaf sheaths long, greenish yellow tinged purple; lamina linear. Inflorescence composed of a single cluster of spikes. Involucre bracts several, leaf-like, exceeding the inflorescence. Spikes oblong, slightly compressed. Glumes ± 2 mm, broadly ovate with a wide keel, apex obtuse or retuse, mucronate, margins scarious, silvery, sometimes reddish brown or tinged purple. Stamens 2. Nut oblong, brown, reticulate.

Flowering and fruiting. February.

Distribution and habitat. Southern Oman, Dhofar, in mud at edge of permanent water pools. *Altitude*: ± 200 m. Also Somalia, and from Oman to Pakistan and NW India. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 50.

Notes. Ghazanfar 1649 from Dhofar, Jebel Qara, Wadi Darbat, (collected 23 Feb. 1992, wrongly identified as *C. rotundus*) is referable to this taxon.

7. **Kyllinga** Rottb. *nom. conserv.*
About 50 species in tropical Africa and Asia, Africa, South and North America.

Kyllinga brevifolia Rottb., Descr. Icon. Rar. Pl.: 13 (1773).
Synonym. Cyperus brevifolius (Rottb.) Hassk. (1844).

Description. Rhizomatous perennial, up to 20 cm; rhizome slender, creeping. Stems green, erect, trigonous, glabrous. Leaves shorter than stems; leaf sheaths greyish, sometimes reddish, scarious; lamina linear, up to 10 cm, flat, ± keeled, sometimes folded, margins smooth, apex acute, margins and midrib below scabrous. Inflorescence of a single dense head. Involucre bracts 2–3, exceeding the inflorescence. Spikelets lanceolate, 2 mm, 1-flowered. Rachilla not winged. Glumes 2, ovate, acuminate, mucronate, keeled, mid-vein minutely setulose, green, sides scarious. Stamens 3. Stigmas 2. Nut compressed, obovoid, beaked, yellowish, papillose.

Flowering and fruiting. June.

Distribution and habitat. Northern Oman, in wadis of the Western Hajar mountains, on

moist soil in water seepage from *falaj*. *Altitude*: ± 330 m. Almost cosmopolitan. Not recorded elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 51.

Notes. Known from a single record from the hot springs near Nakhl, but probably overlooked and under-collected.

8. **Schoenus** L.

A genus of about 80 species, almost cosmopolitan.

Schoenus nigricans L., Sp. Pl.: 43 (1753).

Description. Densely tufted perennial. Rhizome short; roots fleshy, dark purplish. Stems greyish green, 15–80 cm, erect, terete to somewhat flattened above, deeply grooved. Leaves basal, greyish green, up to 40 cm, narrowly linear, wiry, apex obtuse, margins smooth; leaf sheath up to 8 cm, shiny, reddish or blackish brown; ligule present, often minutely ciliate. Inflorescence of a blackish capitate head of tightly overlapping spikelets, each fascicle subtended by a glume-like bract. Involucre bracts 2–3, leaf-like, sheathing at base, the lowermost longer than inflorescence. Spikelets flattened, acute, dark brown to blackish; rachilla thick, zig-zag, winged. Glumes distichous, keeled, acute to shortly apiculate, margins membranous, mid-vein scabrous; the lowest two glumes sterile, the others fertile. Flowers bisexual; perianth bristles 3–4, much shorter than the nut. Stamens 3. Stigmas 3. Nuts 1–2 mm, ovoid to ellipsoid, obtusely trigonous, smooth, shiny, creamy-white to grey.

Flowering and fruiting. January, February & July to September.

Distribution and habitat. Northern and southern Oman; in northern Oman on the Hajar mountains, in southern Oman, in Dhofar, in wadis, on damp mud around permanent fresh water and slightly brackish water pools. *Altitude*: 80–1500 m. Cosmopolitan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 52.

9. **Cladium** P.Browne

Two species, one cosmopolitan, and the other North American.

Cladium mariscus (L.) Pohl, Tent. Fl. Bohem. 1: 32 (1809) subsp. ***mariscus***
Synonym. Schoenus mariscus L. (1753).

Description. Perennial, up to 90 cm, tufted, with a branched woody rhizome covered with triangular scales, dark purple-brown. Stems grey-green, hollow, terete, finely ridged, covered with leaf sheaths at base, smooth. Leaves spiral along the length of stem; leaf sheath to 15 cm, hard, persistent, brown; ligule absent; blade to 50 × 5–9 cm, flat or folded, apex acuminate, trigonous, midrib below and margins sharply scabrous, greyish green. Inflorescence of partial inflorescences with the upper overlapping; bracts longer than the partial inflorescence; peduncles to 25 cm, flattened with serrulate margins, branched 2–3 times, branches with

prophylls, subtended by bracts, unequal, non-sheathing, the last bearing clusters of spikes. Spikes, fusiform, 4 mm; lowest 2–3 glumes sterile. Flowers unisexual and bisexual; unisexual flower with 2 stamens present in the axil of 4th glume; bisexual flower with 2 stamens and pistil present in the axil of 5th glume. Stigmas 3. Nut fusiform, yellow brown, smooth, glossy.

Flowering and fruiting. June.

Distribution and habitat. Southern Oman, Dhofar, in brackish swamps, and by edges of permanent pools; not common, collected a few times from Shuwaymiyah in SE Oman. *Altitude*: 20–550 m. Europe, Caucasus and Turkey eastwards to Iraq, Iran, Pakistan and Kashmir; N Africa, through Arabia to Palestine and Syria; Kazakhstan. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration. 53.

13. **Poaceae** (Gramineae)

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The eMonocot portal. http://e-monocot.org.

Poaceae is the largest family in Oman represented by 248 species, found in all habitats and at all altitudes. The following account has been adapted from Poaceae in *Flora of the Arabian Peninsula and Socotra* Vol. 5(1). Species descriptions are largely unchanged. To adapt to the format of *Flora of Oman*, I have removed Tribe and generic descriptions, and, for each species added notes on distribution and habitats for Oman. I have consulted GrassBase [http://www.kew.org/data grasses-db.html] and the e-Monocot portal [http://e-monocot.org] for generic distributions and the number of species included in each genus. As images of many taxa in their natural habitats are not available, reference to an illustration is given for most species.

Notes. Terminology related to the inflorescences:

Rhachilla: the slender axis which bears the distichously arranged bracts in a spikelet.

Glumes: the 2 lowermost bracts (empty) of the spikelet.

Lemmas: bracts enclosing a flower and opposed by a hyaline scale (palea).

– Floret: the whole (lemma, palea and flower).

Callus: a horny downward prolongation at base of spikelet or floret.

– Awns: 1 or more stiff bristles on glumes and lemmas.

Key to tribes in the Arabian Peninsula (from Cope 2007)

Tribes or genera marked with an asterisk are not represented in Oman

1. Spikelets 1- to many-flowered, breaking up at maturity above the ± persistent glumes or if falling entire then not 2-flowered with the upper floret bisexual and the lower male or barren; spikelets usually laterally compressed or terete 2

Spikelets 2-flowered, falling entire at maturity, with the upper floret bisexual and the lower male or barren and in the latter case often much reduced; spikelets usually dorsally compressed 24

2. Inflorescence a fragile cylindrical raceme with the spikelets sunk in hollows in the axis; glumes collateral and covering the hollows ..... III. **Hainardieae** (p. 41)

Inflorescence not a fragile cylindrical raceme, or if so (*Leptureae) then glumes not collateral 3

3. Ovary with a fleshy hairy apical appendage, the styles arising from beneath it 4

Ovary without a fleshy hairy apical appendage, though sometimes the ovary itself hairy; styles terminal 6

4. Inflorescence a panicle (but this may be reduced to a loose raceme in depauperate specimens); spikelets laterally compressed ..... VI. **Bromeae** (p. 47)

Inflorescence a raceme (spikelets solitary at the nodes) or pseudo-raceme (spikelets 2 or 3 at a node) 5

5. Inflorescence a true raceme, the spikelets shortly pedicelled and ± terete ..... V. **Brachypodieae** (p. 46)

Inflorescence a spicate raceme, the spikelets sessile and laterally compressed, or a pseudo-raceme ..... VII. **Triticeae** (p. 50)

6. Lemmas deeply cleft into 9 awned lobes or 6 lobes alternating with 5 awns ..... X. **Pappophoreae** (p. 64)

Lemmas entire or 2-lobed, awnless or 1– to 3-awned 7

7. Spikelets containing 1 fertile floret (except 39. *Tetrapogon*), with or without 2 barren florets below it or 1 or more above (if fertile floret accompanied by a rhachilla extension bearing a clavate mass of rudimentary lemmas see *Meliceae) 8

Spikelets containing 2 or more fertile florets (except 2 species of **Leptochloa*) 18

8. Glumes both suppressed (the 2 scales at the base of the leathery fertile lemmas being barren florets) ..... *Oryzeae

Glumes, or at least one of them, well developed 9

9. Spikelets falling entire at maturity, either singly or in clusters, from the persistent axis of racemes or spike-like panicles; lemmas delicately 1- to 3-veined (if spikelets falling entire with the pedicel or part of it from a contracted lobed panicle, or spikelets falling in clusters and glumes exceeding the indurated fertile lemmas, see IV. Aveneae; if lemmas with geniculate awn see VIII. Arundineae) ..... XII. **Cynodonteae** (p. 97)

Spikelets breaking up at maturity above the persistent glumes 10

10. Inflorescence composed of racemes, these solitary, digitate or disposed along an axis 11

Inflorescence a panicle, either open or contracted and spike-like 12

11. Spikelets arranged in 1-sided racemes ..... XII. **Cynodonteae** (p. 97)

Spikelets embedded in alternate sides of a fragile cylindrical axis ..... *Leptureae

12. Spikelets strictly 1-flowered 13
Spikelets 2- to 3-flowered 16
13. Lemma with 3 awns, these often connate at the base above a twisted column (rarely only 1 awn present but then the lemmas with a semi-circular bend at the summit; very rarely the awns reduced to no more than minute bristles) ..... IX. **Aristideae** (p. 55)
Lemma awnless or with a single awn 14
14. Lemma hardened at maturity, awned from the tip ..... I. **Stipeae** (p. 38)
Lemma hyaline or membranous at maturity 15
15. Lemma usually awned; glumes longer and firmer than the hyaline lemmas; caryopsis with adherent pericarp ..... IV. **Aveneae** (p. 41)
Lemma awnless; glumes and lemmas similar in texture, the former often the shorter; caryopsis with loose pericarp that swells and ejects the seed on wetting ..... XI. **Eragrostideae** (p. 66)
16. Florets 2 per spikelet, the lower well developed but male or barren, the upper bisexual ..... XV. **Arundinelleae** (p. 130)
Florets 3 per spikelet, or if only 2 then the lower small, chaffy and vestigial 17
17. Barren lemmas small, chaffy and vestigial; fertile lemmas hardened and shiny, shorter than the glumes ..... IV. **Aveneae** (p. 41)
Barren lemmas longer than the fertile, at least one of them transversely ridged or wrinkled, the florets exceeding the small glumes ..... *Ehrharteae
18. Tall reed-like grass with large plumose panicle ..... VIII. **Arundineae** (p. 52)
Slender grass without large plumose panicle 19
19. Spikelets 2-flowered, both lemmas hardened and ± hemispherical; spikelets awnless ..... XIV. **Isachneae** (p. 129)
Spikelets 2- to several-flowered, the lemmas not as above, either membranous or awned 20
20. Glumes shorter than the adjacent lemmas, with the florets distinctly exserted; lemmas awnless or with a straight awn from the entire or bilobed tip 21
Glumes longer than the adjacent lemmas, usually as long as the spikelet and enclosing the florets, rarely shorter but then the lemmas usually with a geniculate or dorsal awn 23
21. Lemmas 1- to 3-veined (sometimes becoming 5- to 7-veined in the upper part) ..... XI. **Eragrostideae** (p. 66)
Lemmas 5- to many-veined throughout, if 3-veined then inflorescence a dichotomously branched panicle (**Cutandia*) 22
22. All lemmas fertile or the uppermost progressively reduced but similar in appearance to the lower ..... II. **Poeae** (p. 39)
Only the lowermost 1 or 2 lemmas fertile, the uppermost barren and reduced to a clavate mass at the tip of the rhachilla ..... *Meliceae
23. Lemmas awned from the back, rarely awnless; ligule a membrane .. IV. **Aveneae** (p. 41)

Lemmas awned from the sinus of the prominently 2-lobed tip; ligule a fringe of hairs ..... VIII. **Arundineae** (p. 52)

24. Spikelets solitary, rarely paired but then those of a pair alike; glumes usually membranous, the lower mostly the smaller and sometimes suppressed; upper lemmas papery to polished and stony, awnless or at most shortly mucronate ..... XIII. **Paniceae** (p. 105)

Spikelets typically paired with one sessile and the other pedicelled, those of a pair usually dissimilar (the pedicelled sometimes much reduced), rarely the spikelets all alike; glumes as long as the spikelet and enclosing the florets, ± rigid and firmer than the hyaline or membranous lemmas; upper lemmas often with a geniculate awn ..... XVI. **Andropogoneae** (p. 132)

Tribe I. STIPEAE Dumort.

1. **Stipa** L.

About 300 species, cosmopolitan, except Antartica.

Annual; awns eventually twisted together to form a spire at the summit of the panicle ..... 1. **S. capensis**

Perennial; awns not twisted together into a spire ..... 2. **S. mandavillei**

1. ***Stipa capensis*** Thunb., Prodr. Fl. Cap. 1: 19 (1794).

Synonym. Stipa tortilis Desf. (1798).

Description. Annual up to 50 cm high (usually much less). Panicle usually not fully exserted from the uppermost sheath. Glumes narrowly lanceolate-acuminate, hyaline, the lower 6–24 mm long, the upper 4–22 mm long; lemmas, including the 1.7–2.3(–3.5) mm pungent callus, 5.5–8(–9) mm long; awns 6.5–10(–13.5) cm long, bigeniculate, with hairy column and scabrid limb, eventually twisted together to form a spire at the summit of the panicle.

Flowering and fruiting. April.

Distribution and habitat. Northen Oman, Musandam, in sandy and gravelly soils, wadi beds and rock crevices. *Altitude*: ± 150 m. Mediterranean region to Northwest India; South Africa (probably introduced). Elsewhere in the Arabian Peninsual found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration. 54; Cope, 2007: fig.1, C.

2. ***Stipa mandavillei*** Freitag in Kit Tan (ed.), Davis & Hedge Festschrift: 118 (1989) – Type: Oman, Jebal Akhdar, Birkat Sharif, *Mandaville* 6525 (holo. BM).

Description. Tufted perennial up to 65 cm high. Panicle loosely contracted, exserted from or partly enclosed by the uppermost sheath. Glumes unequal, lanceolate-acuminate with broad hyaline margins, the lower 7–10 mm long, the upper 6.5–9 mm long; lemmas, in-

cluding the 0.5–0.7 mm curved pointed callus, 4.5–5.5 mm long; awn 2.5–4 cm long, unigeniculate or indistinctly bigeniculate, with hairy column and scabrid limb.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, on rocky slopes, mostly confined to the Jebel Akhdar range, extending to the Musandam mountains and possibly Dhofar. *Altitude*: 1500–2400 m. Endemic; not known elsewhere.

Distribution map & Illustration. 55.

Tribe II. POEAE

A large tribe usually recognized by the simple spikelets with short glumes, several florets and 5-veined lemmas. However, 3-veined lemmas are not uncommon and the spikelet is sometimes reduced to a single floret (*Lamarckia*). Dimorphic spikelets are confined to two genera (*Cynosurus* and (in Oman) *Lamarckia*). The tribe is most likely to be confused with Aveneae, but these usually have long papery or hyaline glumes and dorsal awns.

1. Fertile spikelets intermixed with several sterile spikelets, falling together as a unit ... . 3. **Lamarckia**
   Fertile spikelets not accompanied by sterile spikelets 2
2. Inflorescence a solitary raceme; lateral spikelets without a lower (inner) glume .... 1. **Lolium**
   Inflorescence a panicle, or if racemose then all spikelets with both glumes 3
3. Lemmas tuberculate on the back, strongly veined and translucent between the veins . ..... 2. **Castellia**
   Lemmas not as above, not tuberculate, rounded on the back ..... 4. **Catapodium**

1. **Lolium** L.

Eight to 12 species, cosmopolitan.

Lolium temulentum L., Sp. Pl. 1: 83 (1753).

Description. Annual up to 120 cm high. Raceme erect, 5–40 cm long, rigid. Spikelets 8–28 mm long, 2- to 10(–15)-flowered; glume 7–30 mm long, three-quarters as long as the spikelet to exceeding the florets, 7- to 9(–11)-veined, obtuse; lemmas elliptic to ovate, 4.6–8.5 mm long, smooth, obtuse, very turgid at maturity, awnless or with an awn up to 23 mm long.

Flowering and fruiting. April; September.

Distribution and habitat. Northern and Southern Oman, as a weed of cereals; not common. *Altitude*: 1200–2400 m. Native in the Mediterranean region and Southwest Asia, but widely introduced elsewhere. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 56; Collenette, l.c., p. 391.

2. **Castellia** Tineo
Monotypic; Europe, Africa, temperate and tropical Asia.

Castellia tuberculosa (Moris) Bor in Indian Forester 74: 90 (1948).
Synonym. Catapodium tuberculosum Moris (1841).

Description. Annual. Culms up to 75(–100) cm high. Inflorescence a 4–26 cm raceme or with a few simple racemose branches below, the spikelets sessile or nearly so, alternate in opposite rows. Spikelets 6–15-flowered, laterally compressed, disarticulating below each floret; glumes unequal, ± keeled, acute to obtuse, the lower 3-veined, the upper 3–5-veined; lemmas 4.2–5.7 mm long, membranous, thinly 5-veined, rounded on the back, awnless, densely tuberculate except in the upper part, obtuse to subacute.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, on damp sandy soils and on rocky hillsides in shrubby vegetation. *Altitude*: 50–350 m. Mediterranean region, Sudan, Ethiopia, Djibouti, Somalia and Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration. 57; Collenette, l.c., p. 359.

3. **Lamarckia** Moench
Monotypic; Europe, Africa, temperate and tropical Asia, Australasia, Pacific, North and South America.

Lamarckia aurea (L.) Moench, Methodus: 201 (1794).
Synonym. Cynosurus aureus L. (1753).

Description. Culms up to 15(–25) cm high; uppermost leaf-sheaths slightly inflated. Panicle 2–6 cm long, usually golden-yellow but sometimes tinged with purple; pedicels villous. Fertile spikelet 2–4 mm long; glumes linear-lanceolate; lemmas ovate, 2–2.5 mm long; awn 6–10 mm long; sterile rudiment ± 0.5 mm long with an awn 4–7 mm long. Sterile spikelets 5–8 mm long; glumes linear-lanceolate, 3–3.5 mm long; lemmas ovate.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, Musandam, on the mountains, on hillsides, amongst rocks and in shaded crevices; not common. Native to the Mediterranean and neighbouring regions from Portugal to the Canary Islands, east to Ethiopia and northern India; naturalized in parts of Australia and the Americas; an invasive weed in some areas. *Altitude*: 1000–1200 m. Elsewhere in the Arabian Peninsula found Saudi Arabia, Yemen; expected to be found in the UAE.

Distribution map & Illustration. 58; Collenette, l.c., p. 388.

4. **Catapodium** Link
Scleropoa Griseb.

Two species; Europe, temperate Asia, Australasia, North and South America.

Catapodium rigidum (L.) C.E.Hubb. in Dony, Fl. Bedfordshire: 437 (1953).

Description. Erect or ascending glabrous annual up to 30 cm high; ligule blunt, 1–3 mm long; leaf-blades flat or loosely inrolled, up to 10 cm × 0.5–2 mm. Panicle linear to ovate in outline, 1–8 cm long, the main axis and branches 3-angled. Spikelets narrowly oblong, 3.5–7 mm long, rounded on the back; glumes up to 2 mm long, the lower lanceolate, the upper elliptic; lemmas narrowly oblong in profile, 2–2.5 mm long, obtuse; anthers ± 0.3 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on the plains, outflow of wadis on stony and sandy soils. *Altitude*: ± 1 m. Western & southern Europe, North Africa and western Asia; introduced in North & South America, South Africa and Australia. Elsewhere in the Arabian Peninsula found Saudi Arabia, Yemen.

Distribution map & Illustration. 59; Collenette, l.c., p. 359.

Tribe III. HAINARDIEAE Greuter

6. **Parapholis** C.E. Hubb.

Six species; Europe, the Mediterranean Region and Southwest Asia; widely introduced to other temperate countries.

Parapholis incurva (L.) C.E.Hubb. in Blumea, suppl. 3: 14 (1946).
Synonym. P. marginata auct. non Runemark (1990).

Description. Annual. Culms up to 25 cm high, often strongly curved. Raceme with fragile rhachis. Spikelets 1-flowered; glumes acute, 6–6.5 mm long, wingless on the keel; lemmas hyaline, 3-veined, the lateral veins very short. Anthers 0.5–1 mm long.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, Musandam, as weed of lawns and gardens. *Altitude*: ± 50 m. Western Europe through the Mediterranean region to Southwest Asia. Elsewhere in the Arabian Peninsula found Bahrain, Kuwait, Qatar, Saudi Arabia.

Distribution map & Illustration. 60; Collenette, l.c., p. 397.

Tribe IV. AVENEAE Dumort.

1. Spikelets with 2 or more fertile florets, sometimes the uppermost reduced, if 1-flowered then lemmas with 2 setose apical teeth 2
Spikelets with 1 fertile floret, sometimes with 1 or 2 sterile florets below it reduced to small chaffy scales; tip of lemmas without setose teeth 3

2. Spikelets large, 14–50 mm long, pendant in a large open panicle up to 40 cm long .... 7. **Avena**
   Spikelets much smaller, 2.5–7.5 mm long, in a condensed panicle ..... 8. **Rostraria**
3. Spikelets 2- to 3-flowered, the uppermost floret fertile, hard and shining, the 1 or 2 sterile florets below it reduced to small chaffy scales; sometimes the spikelets falling in a cluster of 1 fertile spikelet surrounded by an involucre of 5 or 6 sterile .... 9. **Phalaris**
   Spikelets strictly 1-flowered, the floret not hard and shining (if so, see tribe III Stipeae) 4
4. Spikelets breaking up above the persistent glumes 5
   Spikelets terete, falling entire with a basal stipe ..... 11. **Polypogon**
5. Glumes swollen and slightly toughened below, membranous above; panicle spikelike ..... 10. **Gastridium**
   Glumes membranous throughout, not swollen below ..... 11. **Polypogon**

7. **Avena** L.

Ten to 15 species; almost cosmopolitan.

1. Rhachilla continuous between the florets, not disarticulating at maturity except sometimes below the lowermost floret only, fracturing horizontally at the base of the lower most lemmas when forced, the latter usually glabrous ..... 1. **A. sativa**
   Rhachilla disarticulating at the base of each floret, these falling separately at maturity 2
2. Tip of lemmas with 2 awned teeth, the awns up to 2 mm long ..... 2. **A. barbata**
   Tip of lemmas with 2 acute teeth or these atmost shortly mucronate ..... 3. **A. fatua**

1. ***Avena sativa*** L., Sp. Pl. 1: 79 (1753).

Description. Culms up to 150 cm high. Panicle patent or contracted and secund, up to 25(–40) cm long. Spikelets 17–30 mm long, 2- to 3-flowered, the rhachilla tough, not disarticulating either above the glumes or between the florets but fracturing horizontally when forced; glumes broadly elliptic, acuminate; lemmas 2–25 mm long, glabrous on the callus, glabrous or sparsely hairy on the back below, emarginate or minutely 2-toothed at the tip, the teeth muticous; central awn 1.5–4 cm long, usually straight, often quite absent.

Flowering and fruiting. March.

Distribution and habitat. Oat is cultivated as a cereal in most temperate countries, and often found as an escape. A single collection from the Batinah; probably an escape from cultivation. *Altitude*: ± 50 m. Elsewhere in the Arabian Peninsula recorded from Kuwait.

Distribution map & Illustration. 61.

2. ***Avena barbata*** Pott ex Link in J. Bot. (Schrader) 2: 315 (1799) subsp. ***barbata***.

Synonym. A. alba auct. non Vahl.

Description. Culms up to 100 cm high. Panicle erect, subsecund, up to 30(–50) × 12 cm. Spikelets (18–)20–30 mm long, 2- to 3-flowered, the rhachilla disarticulating at the base of each floret; glumes lanceolate, finely acute; lowermost lemmas 16–20 mm, densely bearded around the neat elliptical basal callus, densely hairy in the lower two-thirds, scabrid or asperulous above, narrowed upwards and finely 2-toothed at the tip, the teeth each with an awn 3–12 mm long; central awn 3–6 cm long, geniculate.

Distribution and habitat. Northern Oman, Musandam, on hillsides, amongst rocks. *Altitude*: ± 600 m. Europe and North Africa eastwards to Central Asia. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen.

Distribution map & Illustration. 62; Collenette, l.c., p. 348.

Notes. Subsp. *wiestii* (Steud.) Mansf., Kulturpfl. Beih. 2: 479 (1959), with spikelets 4–6(–8) mm long, and the lowermost lemmas 2–4 mm long, is recorded from Saudi Arabia.

3. ***Avena fatua*** L., Sp. Pl. 1: 80 (1753).

Description. Culms up to 150 cm high. Panicle nodding, narrowly to broadly pyramidal, 10–40 × up to 20 cm, loose. Spikelets 18–28 mm long, 2- to 3-flowered, the rhachilla disarticulating at the base of each floret; glumes lanceolate, finely acute; lemmas 14–20 mm long, densely bearded around the horse-shoe-shaped basal callus, stiffly hairy in the lower two-thirds, scabrid above, unequally and shortly 2- to 4-toothed at the tip, the teeth muticous or shortly mucronate; awn 2.5–4 cm long, geniculate.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, in sandy soils, as a weed of cereals and lucerne. *Altitude*: ± 250 m. Temperate Old World. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 63; Collenette, l.c., p. 349.

8. **Rostraria** Trin.
Lophochloa Rchb.
Ten species; Europe, Africa, Asia, Australasia, North and South America.

Glumes unequal, the lower markedly shorter and narrower than the upper; rhachilla not longer than uppermost floret, ± glabrous; hairs less than 0.5 mm long .... 1. **R. cristata**
Glumes subequal; rhachilla longer than uppermost floret, densely hairy; hairs up to 1 mm ..... 2. **R. pumila**

1. ***Rostraria cristata*** (L.) Tzvelev in Novosti Sist. Vyssh. Rast. 7: 47 (1971).
Synonym. Festuca cristata L. (1753).

Description. Culms up to 60 cm high. Panicle cylindrical and dense or pyramidal and lax and ± lobed, 1–12 cm long. Spikelets 3- to 6(–10)-flowered, 3–7.5 mm long; rhachilla

not longer than uppermost floret, ± glabrous or with hairs less than 0.5 mm long; glumes glabrous or hairy, acute, the lower narrowly lanceolate, 2–3 mm long, 1-veined, the upper elliptic, 2.5–3.5 mm long, 3-veined; lemmas 2.5–3.5 mm long, glabrous or sparsely hairy, the surface smooth or minutely papillose, acute; awn 1–3 mm long.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, Musandam, in silty and sandy soils, especially in cultivations. *Altitude*: ± 250 m. Mediterranean region eastwards to northwest India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

Distribution map & Illustration. 64; Collenette, l.c., p. 407.

2. ***Rostraria pumila*** (Desf.) Tzvelev in Novosti Sist. Vyssh. Rast. 7: 48 (1971).
Synonym. Avena pumila Desf. (1798).

Description. Culms up to 35 cm high. Panicle ovate-oblong, lax and sometimes ± lobed, 1–6 cm long. Spikelets usually 4-flowered, 2.5–3.5 mm long; rhachilla longer than uppermost floret, densely villous with hairs up to 1 mm long; glumes subequal, elliptic, 2.5–3 mm long, the lower shortly and densely villous all over with slightly crisped hairs, the upper less hairy and then usually only on the keel, or glabrous, rarely hairy all over; lemmas 3–3.5 mm long, glabrous, acute; awn 1.5–2.5 mm long.

Flowering and fruiting. February/March.

Distribution and habitat. Norhern Oman, along the Batinah coast and inland, on sandy and silty soils, rocky hillsides and cultivated areas. *Altitude*: 20–650 m. Mediterranean region eastwards to northwest India. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration. 65; Collenette, l.c., p. 407.

9. **Phalaris** L.
About 16 species, cosmopolitan except Antarctica.

Spikelets in deciduous clusters of 6 or 7, with 5 or 6 sterile, deformed spikelets forming an involucre about a single fertile spikelet; spikelets falling from the inflorescense in groups ..... 1. **P. paradoxa**
Spikelets solitary, not in clusters, all of them fertile and breaking up above the persistent glumes ..... 2. **P. minor**

1. ***Phalaris paradoxa*** L., Sp. Pl., ed. 2, 2: 1665 (1763).
Synonym. P. paradoxa var. *praemorsa* (Lam.) Coss. & Durieu (1854).

Description. Annual up to 100 cm high. Panicle up to 9 × 2 cm, dense, oblong, tapering to a narrow base; spikelets falling from the inflorescence in groups of 6 or 7, with 5 or 6 sterile, deformed spikelets forming an involucre about a single fertile spikelet. Glumes of fertile

spikelet 5.5–8.2 mm long, acuminate to subulate, winged above, the wing with a tooth-like projection near the middle; sterile florets of fertile spikelet obsolete; fertile floret 2.5–3.3 mm long, glabrous or with a few short hairs near the tip.

Flowering and fruiting. March/April.

Distribution and habitat. Northern Oman, Musandam, on cultivated and disturbed ground. *Altitude*: ± 150 m. Europe and the Mediterranean region eastwards to southwest Asia; widely introduced. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, Yemen.

Distribution map & Illustration. 66; Collenette, l.c., p. 402.

2. ***Phalaris minor*** Retz., Observ. Bot. 3: 8 (1788).

Description. Annual up to 100 cm high. Panicle 1–6 × 1–2 cm, dense, ovate-oblong. Spikelets all alike, fertile, disarticulating above the persistent glumes; glumes oblanceolate-acute, 4–6.5 mm long, broadly winged, the wing margin usually erose-denticulate, rarely almost entire; sterile florets very unequal, the lower obsolete, the upper subulate and 1–1.8 mm long, rarely both obsolete (not yet noted for Arabia); fertile lemmas broadly lanceolate-ovate, 2.7–4 mm long, grey-brown and glossy at maturity, pubescent.

Flowering and fruiting. March/April.

Distribution and habitat. Northern Oman, on sandy soils, in cultivated fields and gardens. *Altitude*: 50–150 m. Mediterranean region to Pakistan and the Northwest Himalaya; introduced in temperate countries throughout the world. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Flowering and fruiting. April.

Distribution map & Illustration. 67; Collenette, l.c., p. 402.

10. **Gastridium** P.Beauv.

Two species; Europe, Africa, temperate Asia, Australasia, North and South America.

Gastridium phleoides (Nees) C.E.Hubb. in Kew Bull. 9: 375 (1954).
Synonym. Lachnagrostis phleoides Nees & Meyen (1841).

Description. Annual. Culms up to 60 cm high. Panicle linear-oblong to lanceolate in outline, up to 18 × 5 cm, dense. Spikelets 1-flowered, linear-oblong, (3.5–)5–7.5 mm long, the rhachilla produced as a short, slender, hairy bristle; Glumes unequal, membranous above, indurated and gibbously swollen below to accommodate the floret, 1-veined, acuminate; lower glume as long as the spikelet; upper glume about three-quarters as long; awned lemmas 1–1.3 mm long, densely hairy all over, the awn 4–6(–7) mm long.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, Musandam, in the mountains in small wadis, on rocky slopes, amongst shrubs. *Altitude*: ± 1400 m. Also Sudan, Ethiopia and Kenya

northwards to the southern Mediterranean region and eastwards through Turkey to Iran. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 68; Collenette, l.c., p. 384.

11. **Polypogon** Desf.
About 22 species; cosmopolitan.

Annual; glumes long-awned ..... 1. **P. monspeliensis**
Perennial; glumes awnless ..... 2. **P. viridis**

1. ***Polypogon monspeliensis*** (L.) Desf., Fl. Atlant. 1: 67 (1798).
Synonyms. Alopecurus monspeliensis L. (1753); *Phalaris cristata* Forssk. (1775).

Description. Annual up to 80 cm high. Panicle spike-like, 1.5–16 cm long, very dense and bristly. Spikelets 1-flowered without rhachilla extension, falling entire together with a basal stipe, spikelets 2–3 mm long (excluding the awns); glumes equal, slightly notched at the tip, scabrid below, minutely hairy on the margins, with a fine straight awn 4–7 mm long; lemmas about half the length of the glumes, smooth, awnless or with an awn up to 2 mm long.

Flowering and fruiting. March to October.

Distribution and habitat. Northern and Southern Oman, on sandy soil, by streams, and in irrigated areas. *Altitude*: 0–1500 m. Warm temperate regions of the Old World. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE; also found on Soqotra.

Distribution map & Illustration. 69; Collenette, l.c., p. 406.

2. ***Polypogon viridis*** (Gouan) Breistr. in Bull. Soc. Bot. France 110 (Sess. Extr.): 56 (1966).
Synonyms. Agrostis viridis Gouan (1762); *Phalaris semiverticillata* Forssk. (1775).

Description. Stoloniferous perennial up to 100 cm high. Panicle pyramidal, lobed, 2–15 cm long, dense, the branches subverticillate. Spikelets 1.5–2.5 mm long; glumes obtuse, scabrid on the back, awnless; lemma ± 1 mm long, denticulate at the tip, awnless.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, in wadis, on moist ground and in areas of cultivation; *Altitude*: 450–500 m. Mediterranean region eastwards to northwest India; widely introduced. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 70; Collenette, l.c., p. 407.

Tribe V. BRACHYPODIEAE Harz

An anomalous tribe sometimes placed between Bromeae and Triticeae (or even united with the latter) with which it shares hairy lodicules, hairy ovary appendage and simple rounded

starch grains. However, its small chromosomes are unusual for either tribe and point to a closer affinity with Meliceae.

12. **Brachypodium** P.Beauv.
Trachynia Link
Twenty species; Africa, Eurasia, and South America.

Brachypodium distachyum (L.) P. Beauv., Ess. Agrostogr.: 101, 155 (1812).
Synonym. Bromus distachyos L. (1753).

Description. Annual up to 40 cm high, but often much less, usually geniculately ascending; leaf-blades up to 2 cm × 4 mm, flat, stiff, glaucous. Raceme with 1–4(–6) spikelets crowded at the top of the culm. Spikelets 20 -30(–60) mm long, lightly compressed, oblong-lanceolate, 10- to 16(–30)-flowered; glumes unequal, hairy or glabrous, acute, the lower lanceolate, 5 -6 mm long, 5-veined, the upper oblong-lanceolate, 7–8 mm long, 7-veined; lemmas oblong-lanceolate, 7.5–10 mm long, glabrous or with a few stiff bristles to pubescent, tipped with an awn up to half as long again as the body; anthers 0.5–1 mm long.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, on sandy soils in wadis and along roadsides. *Altitude*: 350 -400 m. Mediterranean region eastwards to southwest & central Asia; introduced elsewhere. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 71; Collenette, l.c., p. 354.

Tribe VI. BROMEAE Dumort.

Bromeae and Triticeae share the same unusual starch grains in the endosperm: rounded rather than angular or compound. They also share the fleshy appendage on the ovary which is apparent even in immature specimens. The latter character is the best means of distinguishing Bromeae from Poeae.

13. **Bromus** L.
Anisantha K. Koch; *Ceratochloa* P. Beauv.; *Genea* (Dumort.) Dumort.; *Triniusa* Steud.
About 160 species; cosmopolitan except Antartica.

1. Lemmas, or at least the uppermost in the spikelet, 3-awned; lemma margin widened above the middle into a very distinct obtuse angle ..... 1. **B. danthoniae**
   Lemmas 1-awned 2
2. Lemmas 2–3 mm wide 3
   Lemmas less than 2 mm wide, terete with overlapping margins; awns slightly recurved ..... 3. **B. fasciculatus**

3. Panicle very lax, 5–25 cm long, nodding or erect with ascending branches, often somewhat 1-sided ..... 2. **B. pectinatus**
Panicle 6–13 cm long, loosely contracted, erect ..... 4. **B. madritensis**

1. ***Bromus danthoniae*** Trin. in C.A. Mey., Verz. Pfl. Casp. Meer: 24 (1831).

Description. Annual up to 50 cm high. Panicle ovate, 4–12 cm long, the branches short and ascending. Spikelets elliptic or oblong-elliptic, 5–35(–45) mm long (excluding the awns); lower glume lanceolate, 5–8.5 mm long, 3- to 5-veined; upper glume narrowly ovate, 6.5–9.5 mm long, 7- to 9(–11)-veined; lemmas oblanceolate in profile, 8–12 mm long, herbaceous with broad silvery-hyaline margins widened above the middle into an obtuse angle, 9- to 11-veined, minutely several- toothed at the tip, 3-awned (the lowermost often only 1-awned); awns subterminal, usually purple-tinged, the central 10–25 mm long, strongly reflexed, the laterals 4–10 mm long, erect or reflexed.

Flowering and fruiting. May.

Distribution and habitat. Northern Oman, Musandam, on rocky and sandy hillsides. *Altitude*: 250–450 m. Eastern Mediterranean region eastwards to central Asia. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia.

Distribution map & Illustration. 72; Collenette, l.c., p. 355.

2. ***Bromus pectinatus*** Thunb., Prodr. Fl. Cap. 1: 22 (1794).
Synonym. B. adoensis Steud. (1854).

Description. Annual up to 80 cm high. Panicle 5–25 cm long, lax and nodding or erect with ascending branches, often somewhat 1-sided. Spikelets lanceolate, 13–30 mm long (excluding the awns); lower glume narrowly lanceolate, (5–)5.5–8(–10) mm long, (1–)3-veined; upper glume 7–11 mm long, 3- to 5(–7)-veined; lemmas narrowly lanceolate in profile, 7.5–15 mm long, 2–3 mm wide when flattened, herbaceous with hyaline margins, 5- to 7-veined, acute 2- toothed at the tip, awned from 2–3 mm below the tip; awn 7–17 mm long, slender with flattened base, straight or weakly divergent.

Flowering and fruiting. March/April.

Distribution and habitat. Northern Oman, in the foothills of the western Hajar mountains, in small wadis and runnels, amongst rocks and stones. *Altitude*: 300–1200 m. Northeast tropical Africa eastwards through Egypt to Arabia, and southwards to South Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 73; Collenette, l.c., p. 356.

3. ***Bromus fasciculatus*** C.Presl, Cyper. Gramin. Sicul.: 39 (1820).
Synonym. B. fasciculatus var. *alexandrinus* Thell. (1908).

Description. Annual up to 25 cm high. Panicle stiffly erect, 2–5 cm long, fairly dense with rigid branches shorter than the subsessile spikelets. Spikelets cuneate and gaping at matu-

rity, 10–20 mm long (excluding the awns), hairy or glabrous; glumes narrowly lanceolate, the lower 6–8 mm long, veined, the upper 8–11 mm long, 3-veined; lemmas very narrowly lanceolate in profile, outwardly curved at maturity, 11–12(–15) mm long, 1–2 mm wide when flattened, herbaceous with hyaline margins, the margins inrolled and wrapped around the caryopsis at maturity, 2-toothed at the tip, the teeth up to 3 mm long, awned from below the tip; awn 10–15 mm long, recurved at maturity. Caryopsis slightly twisted above.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, Musandam, on rocky hillsides. *Altitude*: 450–1000 m. Mediterranean region and southwest Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration. 74; Collenette, l.c., p. 356.

Notes. Barely distinct from *B. madritensis* and may well turn out not to be anything more than a variety. It has more or less the same geographical distribution but a narrower ecological range. It was discussed by Sales in Bot. J. Linn. Soc. 115: 197–210 (1994) and Scholz in Pl. Syst. Evol. 155: 277–282 (1987). Their contrasting conclusions about how to treat the species say much about the difficulties that are to be encountered. The former stated that the species was probably not distinct from *B. madritensis*, the latter that it was not only quite distinct, but could itself be divided into subspecies.

4. ***Bromus madritensis*** L., Cent. Pl. I: 5 (1755).
Synonyms. Bromus villosus Forssk. (1775); *B. haussknechtii* Boiss. (1884); *B. madritensis* subsp. *haussknechtii* (Boiss.) H.Scholz (1989).

Description. Annual up to 50 cm high. Panicle 6–13 cm long, loosely contracted, the primary branches mostly more than 10 mm long; panicle-axis and culm below the panicle thinly hairy or glabrous. Spikelets cuneate, 18–35 mm long (excluding the awns), 5- to 8-flowered; lower glume narrowly lanceolate to subulate, 7–10 mm long, 1-veined; upper glume narrowly oblong-lanceolate, 10–13 mm long, 3-veined; lemmas narrowly oblong-lanceolate, 12–18 mm long, 2–3 mm wide when flattened, herbaceous with hyaline margins, the margins interned but not wrapped around the caryopsis, 5- to 7-veined, 2- toothed at the tip, the teeth 0.7–2 mm long, with an awn arising from 2–4 mm below the tip; awn 12–30 mm long, flattened below, straight or faintly curved.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, Musandam, on sandy, silty and gravelly soils and in rock crevices. *Altitude*: ± 450 m. Mediterranean region and southwest Asia. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia.

Distribution map & Illustration. 75; Collenette, l.c., p. 356.

Tribe VII. TRITICEAE Dumort.

Generic boundaries in the tribe have been the subject of much discussion and recent treatments (e.g. Löve 1984) define genera on the basis of the genomic constitution of individual species. Unfortunately, these 'genera' can rarely be circumscribed morphologically and therefore have little practical value. Indeed, in *Aegilops* many of these 'genera' have only a single species, making them just as hard to recognize as individual species of the more broadly defined single genus.

Inflorescence a quasi-raceme with spikelets in groups of 3 at the nodes ..... 1. **Hordeum**
Inflorescence a true raceme with the spikelets borne singly at the nodes ..... 2. **Triticum**

14. **Hordeum** L.

Thirty-seven to 39 species; Africa, temperate Europe and Asia, Macaronesia, North and South America.

An instantly recognizable genus of closely related species, the spikelets typically in a cuneate triad that is dispersed as a unit on disarticulation of the rhachis.

Hordeum vulgare L., Sp. Pl. 1: 84 (1753).

Synonym. H. distichon L. (1753).

Description. Annual; culms up to 90 cm high. Raceme 6–12 cm long (excluding the awns), oblong-linear, dense; rhachis tough; triads with only the central spikelet fertile or with all three fertile. Central spikelet 1-flowered plus bristle-like rhachilla extension, dorsally compressed. Glumes 10–30 mm, collateral, narrowly lanceolate, 3-veined and flat or awn-like, not connate at the base; lemma of fertile spikelet ovate-lanceolate, rounded on the back, chartaceous to coriaceous, ± 10 mm long, glabrous on the back, scabrid towards the tip, attenuate to an awn up to 5 cm long; lemmas of lateral spikelets (where infertile) smaller, obtuse, awnless.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, Musandam. Cultivated cereal (barley), often escaping. *Altitude*: ± 500 m. Cultivated throughout the world in temperate regions. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, Yemen.

Distribution map & Illustration. 76.

Notes. The two most common forms are 2-rowed barley, in which only the central spikelet of the triad is fertile, and 6-rowed barley in which all three members of the triad are fertile. Rather less common (and thus far not definitely recorded from Arabia) is 4-rowed barley in which all three members of a triad are fertile but the raceme is looser and the lateral spikelets of alternate rows are in the same line thus giving the appearance of only 4 rows. Cultivated barley has been found in the following countries (though not always as a cereal

crop): Saudi Arabia (2-rowed), Yemen (2-and 6-rowed), Oman (6-rowed), Qatar (2 and 6-rowed), Bahrain (6-rowed) and Kuwait (2-and 6-rowed).

15. **Triticum** L.

Twelve species; Africa, temperate Asia and tropical Asia; widely introduced elsewhere. More than half the species of *Triticum* are cultivated and wheat is the principal cereal of temperate regions. There are three ploidy levels, with 2n = 14, 28 and 42, and within each level selection has proceeded from wild species through hulled cultivated species (in which the caryopsis is difficult to separate from the lemmas and palea). In Arabia, there is one tetraploid hulled species, one tetraploid naked species and one hexaploid naked species in cultivation; there are no wild wheats in Arabia.

Triticum durum Desf., Fl. Atlant. 1: 114 (1798).

Description. Annual. Culms up to 140 cm high, smooth and glabrous throughout, thick-walled, sometimes solid; leaf-blades glabrous. Raceme erect, 3–8 cm long, dense, laterally compressed; rhachis tough, densely ciliate, the internodes 3–4 mm long. Spikelets 5(–7)-flowered, only the lowermost (2–)3–4 florets fertile; glumes broadly ovate, 8–10(–12) mm long, coriaceous, glabrous or pubescent, keeled throughout with 2 keels, one of them prominent, scabridulous, terminating in a 2–3 mm apical tooth, the other weakly developed; fertile lemmas 10–12 mm long, glabrous; awn smooth below, scabrid above, (5.5–)10–15 cm long. Caryopsis naked with flinty endosperm and with a prominent dorsal hump or ridge. 2n = 28.

Flowering and fruiting. January, February.

Distribution and habitat. Northern Oman, where it has been cultivated at the Agricultural Station in Firq, Nizwa. Mediterranean region southwards to Ethiopia, and eastwards to Pakistan. Cultivated in Saudi Arabia, Yemen.

Distribution map & Illustration. 77.

Notes. Macaroni Wheat can be very hard to distinguish from Bread Wheat (*T. aestivum*, q.v.), the most reliable character being the nature of the endosperm (flinty rather than mealy). Other morphological characters are less reliable, but include the keel running from base to tip of the glumes, and the narrow caryopsis somewhat triangular in section with a raised hump or keel on the back. The hard flinty endosperm produces good flour ideal for making pasta.

Triticum aestivum L., the bread wheat, is cultivated almost throughout the world up to latitude 69.5° N. Cultivated in Bahrain, Kuwait, Oman, Saudi Arabia, Yemen. An extraordinarily variable species with innumerable cultivars, and seems to overlap morphologically with several other species, especially *T. durum*, in Arabia. Cultivated specimens are known from Saudi Arabia, southern Yemen and Bahrain.

Tribe VIII. ARUNDINEAE Dumort.

1. Plant tufted with basal leaves; panicle contracted or spike-like 2
   Plant reed-like with leaves all cauline; panicle large and plumose 3
2. Lemmas awnless, the apical teeth subacute to acute ..... 16. **Schismus**
   Lemmas with short hairs in longitudinal lines and with a tuft of long hairs at the summit of each line ..... 17. **Centropodia**
3. Ligule a membrane; lemmas hairy; rhachilla glabrous ..... 18. **Arundo**
   Ligule a line of hairs; lemmas glabrous; rhachilla hairy ..... 19. **Phragmites**

16. **Schismus** P. Beauv.

Five species; SW Europe, NE, N & Southern Africa, SW and C Asia; introduced to N and S America.

Lemma 2–3.5 mm long, the lobes narrowly triangular, 0.6–1.3 mm long; palea shorter than the lemma, seldom reaching beyond the middle of the lobes ..... 1. **S. arabicus**
Lemma 1.5–2 mm long, the lobes broadly triangular, 0.3–0.4(–0.7) mm long; palea almost as long as the lemma, often longer ..... 2. **S. barbatus**

1. ***Schismus arabicus*** Nees, Fl. Afr. Austral. Ill. 1: 422 (1841) – Type: Saudi Arabia, *Schimper* 391 (B).

Synonym. Festuca calycina Forssk. (1775), non Loefl. (1758).

Description. Annual up to 20 cm high. Panicle contracted or spike-like. Spikelets falling entire, or the upper florets falling singly and then the lower florets, glumes and pedicel falling together later; glumes as long as the spikelet or almost so, membranous with hyaline margins, prominently 5- to 7-veined. Glumes 4.5–6.2 mm long; lemmas membranous, 7- to 9-veined, hairy on the back and margins, bilobed or merely notched, ± mucronate in the sinus; lowest lemmas 2–3.5 mm long including the 0.6–1.3 mm narrowly triangular lobes; palea 1.6–2.9 mm long, always shorter than the lemma, seldom reaching beyond the middle of the lobes.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, Musandam, behind sandy beach, on sandy silty soils. *Altitude*: 10–50 m. Eastern Mediterranean region to central Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration. 78; Collenette, l.c., p. 408.

2. ***Schismus barbatus*** (L.) Thell. in Bull. Herb. Boissier, ser. 2, 7: 391 (1907)

Synonym. Festuca barbata L. (1753).

Description. Small annual up to 20 cm high with purplish geniculate stems. Leaves dark green. Glumes 3–4.5(–6) mm long, with hyaline argins; lowest lemmas 1.5–2 mm long

including the 0.3–0.4(–0.7) mm broadly triangular lobes; palea 1.6–2.1 mm long, usually reaching almost to the tips of the lemmas lobes, sometimes exceeding them.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, Musandam and the Batinah, in wadi beds, at foot of limestone hills, on sandy silty soils. *Altitude*: 50–250 m. Mediterranean region, Southwest Asia, southern and southwestern Africa. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration. 79; Collenette, l.c., p. 409.

17. **Centropodia** Rchb.
Asthenatherum Nevski
Four species; Africa, temperate and tropical Asia.

Centropodia forskaolii (Vahl) Cope in Kew Bull. 37: 658 (1983).
Synonyms. Avena forskaolei Vahl (1791); *Avena pensylvanica* Forssk. (1775), non L. (1753).

Description. Perennial, facultatively annual, up to 45 cm high, but rarely over 20 cm. Leaf-blades stiff, flat or rolled, pungent. Panicle 2–7(–14) cm long, contracted. Glumes subequal, 5.5–8.5 mm long, strongly 7- to 11-veined; lemmas 3.7–5.2 mm long including the callus and the narrowly triangular lobes, with a straight awn projecting (0.9–)1.2–2.2 mm beyond the tips of the lobes; anthers 0.7–1.2 mm long.

Flowering and fruiting. March/April.

Distribution and habitat. Northern Oman, in sandy and stony soils. *Altitude*: 50–250 m. Tropical and north Africa to central Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 80; Collenette, l.c., p. 361.

18. **Arundo** L.
Four species; Mediterranean to temperate East Asia and the Philippines; introduced elsewhere.

Arundo donax L., Sp. Pl. 1: 81 (1753).

Description. Tall rhizomatous perennial reeds, culms up to 5 m high (3.5 m the tallest recorded thus far in Arabia); leaves cauline, conspicuously distichous, the blades rounded or cordate at the base, up to 60 × 5 cm; ligule membranous with minutely ciliolate margin. Panicle 30–60 cm long, plumose. Spikelets with glabrous rhachilla; glumes as long as the spikelet, 3- to 5-veined; floret callus short, glabrous; lemmas (6–)8.5–13 mm long, with an awn ± 1.5 mm long, membranous, 3- to 7-veined, plumose below the middle, entire or 2- toothed at the tip, with a short straight awn from between the teeth.

Flowering and fruiting. February, March.

Distribution and habitat. Northern Oman, Musandam, along permanent watercourses. *Altitude*: 250 m. Mediterranean region to Southeast Asia. Introduced in the Arabian Peninsula, found in Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 81; Collenette, l.c., p. 348.

19. **Phragmites** Adans.

Four species; cosmopolitan except Antartica.

Species of *Phragmites* are rather hard to distinguish; they are, for the most part, allopatric, but two species, *P. australis* and *P. karka* (Retz.) Trin. ex Steud meet in Yemen where they may introgress.

Phragmites australis (Cav.) Trin. ex Steud., Nomencl. Bot., ed. 2, 2: 324 (1841).
Synonym. Arundo australis Cav. (1799).

Description. Tall rhizomatous perennial reed; leaves cauline, the blades deciduous; culms 1–4(–6) m high; leaf-blades 20–60 cm × 8–32 mm, flat, smooth beneath, the tip filiform and flexuous, sometimes shorter and tightly rolled, stiff and pungent; ligule a very short membrane with long-ciliate margins. Spikelets with the lowest floret male or empty; rhachilla hairy. Panicle 15–45 cm long, the lowest node usually few-branched, some of the branches bearing spikelets nearly to the base. Spikelets with rhachilla hairs 8–12.5 mm long; hairs copious, silky; glumes shorter than the lowest lemmas, 3- to 5-veined, lower glume ovate, 2.7–5 mm long; upper glume lanceolate or elliptic-oblong, 5.5–9 mm long; floret callus linear, plumose; fertile lemmas hyaline, 1- to 3-veined, glabrous, long-caudate (though the tail very fragile and often breaking off), entire.

a. subsp. ***australis***.

Synonyms. Arundo donax Forssk. (1775), non L. (1753) — Type: Yemen, *Forsskål* (C); *Phragmites communis* Trin. (1820).

Description. Culms up to 4 m high. Panicle 15–20(–30) cm long. Spikelets with upper glume lanceolate, sharply acute and usually apiculate.

Flowering and fruiting. April to November.

Distribution and habitat. Northern and Southern Oman, in marshy and swampy ground, in brackish water and seepages; cultivated at several wet and marshy locations. *Altitude*: 20–350 m. Temperate regions of the World. Elsewere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 82; Collenette, l.c., p. 403.

Notes. Plants with short stiff pungent leaf-blades have been distinguished as var. *stenophylla*, but since shoots of this sort have been found on the same rhizomes as the more typical form, the variety is clearly not worth maintaining.

b. subsp. ***altissimus*** (Benth.) Clayton in Taxon 17: 169 (1968).
Synonym. Arundo maxima Forssk. (1775), *nom. dub.*

Description. Culms up to 6 m high. Panicle 30–45 cm long. Spikelets with upper glume narrowly elliptic-oblong, obtuse to tridenticulate at the tip.

Flowering and fruiting. April to November.

Distribution and habitat. Northern Oman, in and at edges of brackish water pools. Mediterranean shores, eastwards to Iran and southwards to Kenya, Ethiopia and the southern edge of the Sahara. Elsewere in the Arabian Peninsula found in Saudi Arabia, UAE.

Distribution map & Illustration. 83.

Tribe IX. ARISTIDEAE C.E.Hubb.

Central awn, and sometimes also the laterals, plumose ..... 20. **Stipagrostis**
All three awns glabrous ..... 21. **Aristida**

20. **Stipagrostis** Nees

About 68 species distributed in Europe, Africa, temperate and tropical Asia.

1. Body of lemmas articulated at or just above the middle, the awns and column breaking off with the conical upper part of the lemmas (Sect. Schistachne) ..... 1. **S. ciliata**
   Body of lemmas articulated at the summit, the awns and column breaking off cleanly without a part of the lemmas (Sect. Stipagrostis) 2
2. All three awns plumose for the greater part of their length (but sometimes the laterals only thinly so) 3
   Only the central awn plumose, the laterals quite glabrous 4
3. Column of awns 2–3 mm long, pubescent; dwarf plant up to 10 cm high ..... 2. **S. masirahensis**
   Column of awns ± 9 mm long, glabrous; taller plant up to 30 cm high ..... 3. **S. dhofariensis**
4. Lower internodes of the culm covered in dense white wool 5
   Lower internodes of the culm glabrous, or at least not woolly 8
5. Central awn plumose to the base ..... 4. **S. raddiana**
   Central awn glabrous in the lower third to half 6
6. Lower glume 5- to 9-veined, the upper 3- to 5-veined ..... 5. **S. multinerva**
   Both glumes 1- to 3-veined 7
7. Central awn 1.3–1.8 cm long, the feather obtuse in outline; column 1–1.5 mm long ..... 6. **S. acutiflora**
   Central awn 2.5–6 cm long, the feather acute in outline; column 2.5–9 mm long ..... 7. **S. plumosa**
8. Column hairy; glumes 3-veined 9
   Column glabrous, or if pubescent then glumes 5- to 9-veined 10
9. Callus of floret with two collars of hairs, a lower of very short hairs just behind the tip,

and an upper of much longer hairs at the base of the body of the lemmas, the callus glabrous between the collars ..... 8. **S. hirtigluma**

Callus of floret with one continuous collar of hairs, the hairs increasing in length upwards ..... 9. **S. uniplumis**

10. Lower glume with 5–9 prominent scabrid veins ..... 10. **S. sokotrana**
Lower glume 3-veined, the veins neither prominent nor scabrid 11

11. Central awn plumose to the base, 6–7 cm long ..... 11. **S. paradisea**
Central awn glabrous in the lower half, 2–4.5 cm long ..... 12. **S. xylosa**

1. ***Stipagrostis ciliata*** (Desf.) De Winter in Kirkia 3: 133 (1963).
Synonym. Aristida ciliata Desf. (1809).

Description. Densely tufted perennial up to 80 cm high, with conspicuously bearded nodes. Panicle contracted or rather loose, the spikelets pallid and often with a purple spot at the base. Glumes subequal, 3-veined, narrowly ovate, 12–14 mm long, glabrous; lemmas, including both the column and the bearded callus, 10–11 mm long, smooth, passing gradually into the awns without a column or the column well developed and up to 3.5 mm long; column glabrous, it and the awns becoming detached at maturity with the conical upper portion of the lemma; central awn 4–5 cm long, plumose in the upper two-thirds but with a naked excurrent tip; lateral awns up to 2.5 cm long, glabrous.

Flowering and fruiting. February.

Distribution and habitat. Northern Oman, on dry sandy slopes. *Altitude*: ± 250 m. Macaronesia and North Africa to Southwest Asia. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, Yemen.

Distribution map & Illustration. 84; Collenette, l.c., p. 418.

2. ***Stipagrostis masirahensis*** H.Scholz in Willdenowia 13: 389 (1983) – Type: Oman, Masirah Island, *Weisgerber* s.n. (holo. B; iso. ON).

Description. Dwarf, densely tufted perennial up to 10 cm high; internodes glabrous or the upper scabrid. Panicle contracted, few-spiculate, not fully exserted from the uppermost leaf-sheath. Glumes unequal, lanceolate-acuminate, glabrous, the lower 3-veined, ± 12 mm long, the upper 5-veined, ± 17 mm long; lemma, including the bearded callus, ± 4 mm long; column pubescent, 2–3 mm long; central awn ± 4 cm long, plumose in the upper four-fifths, pubescent below; lateral awns ± 3 cm long, plumose in the median three-fifths, pubescent above and below.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, endemic, known only from a few collections from Masirah Island. *Altitude*: ± 50 m.

Distribution map & Illustration. 85.

3. ***Stipagrostis dhofariensis*** Cope in Kew Bull. 47: 660 (1992) – Type: Oman, Kuria Muria Islands [Halaniyah Islands], *Miller* 2757 (holo. E; iso. K, ON).
Synonym. S. lanata auct. non (Forssk.) De Winter.

Description. Tufted perennial up to 30 cm high; internodes glabrous. Panicle contracted. Glumes unequal, 5-veined, lanceolate-acuminate, scrabridulous, the lower ± 12 mm long, the upper ± 20 mm long; lemma, including the bearded callus, ± 5.5 mm long, smooth; column glabrous, ± 9 mm long; central awn 5–6 cm long, plumose throughout; lateral awns 3–4 cm long, plumose throughout (sometimes thinly so) except for the long naked excurrent tip.

Flowering and fruiting. October.

Distribution and habitat. Coastal rocks and sand. *Altitude*: 0–10 m. Endemic; known only from the coast of Oman from Masirah Island to Sahil al Jazir, and coast of Halaniyat Islands.

Distribution map & Illustration. 86.

4. ***Stipagrostis raddiana*** (Savi) De Winter in Kirkia 3: 135 (1963).
Synonym. Aristida raddiana Savi (1837).

Description. Tufted perennial up to 40 cm high; lower internodes woolly. Panicle contracted, not fully exserted from the uppermost sheath. Glumes unequal, lanceolate-acuminate, glabrous, the lower 3-veined, 17–18 mm long, the upper 1(–3)-veined, 14–15 mm long; lemma, including the bearded callus, 5–5.5 mm long, scrabridulous; column glabrous, 11–14 mm long; central awn 5.5–7 cm long, plumose throughout except for the naked excurrent tip; lateral awns 1.5–1.8 cm long, glabrous.

Flowering and fruiting. September.

Distribution and habitat. Southren Oman, foothills of Jebel Qamar, on hillside. *Altitude*: 150–600 m. North Africa and Southwest Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 87; Collenette, l.c., p. 421.

5. ***Stipagrostis multinerva*** H.Scholz in Oesterr. Bot. Z. 117: 289 (1969) – Type: Yemen, *Philby* 22 (holo. BM).
Synonym. S. shawii auct. non (H.Scholz) H.Scholz.

Description. Tufted perennial up to 30 cm high; lower internodes woolly, the lower leaf-sheaths also woolly. Panicle contracted, not fully exserted from the uppermost leaf-sheath. Glumes unequal, lanceolate-acuminate, hairy on the back, the lower 5- to 7-veined, ± 14 mm long, the upper 3- to 5-veined, 14–16 mm long; lemma, including the bearded callus, 6–7 mm long, smooth; column glabrous, ± 5 mm long; central awn 3.5–4.5 cm long, plumose in the upper half but with a naked excurrent tip; lateral awns ± 1.4 cm long, glabrous.

Flowering and fruiting. October.

Distribution and habitat. Southern Oman, on sandy and stony ground. *Altitude*: ± 200 m. Also Egypt (Sinai) and Iran. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 88; Collenette, l.c., p. 419.

6. ***Stipagrostis acutiflora*** (Trin. & Rupr.) De Winter in Kirkia 3: 133 (1963).
Synonym. Aristida acutiflora Trin. & Rupr. (1842).

Description. Tufted perennial up to 65 cm high; lower internodes densely woolly. Panicle contracted. Glumes slightly unequal, lanceolate-acuminate (or the upper frequently mucronate), scrabridulous, the lower 1- to 3-veined, 8–8.5 mm long, the upper 3-veined, 8.5–9 mm long; lemma, including the bearded callus, 4.5–5 mm long, smooth; column glabrous, 1–1.5 mm long; central awn 1.3–1.8 cm long, plumose in the upper half but with a naked excurrent tip, the feather nevertheless very obtuse in outline; lateral awns 0.6–0.8 cm long, glabrous.

Flowering and fruiting. August.

Distribution and habitat. Northern Oman, Wahiba Sands, on dunes and sandy hummocks. *Altitude*: 80–500 m. North Africa. Elsewhere in the Arabian Peninsula found in UAE, Yemen.

Distribution map & Illustration. 89.

7. ***Stipagrostis plumosa*** (L.) Munro ex T.Anderson, J. Proc. Linn. Soc., Bot. 5(Suppl. 1): 40 (1860).
Synonym. Aristida plumosa L. (1763).

Description. Slender tufted perennial up to 40 cm high, sometimes robust and up to 1m high; lower internodes densely woolly, the lower leaf-sheaths also woolly or rarely glabrous. Panicle usually contracted, but lax in the more robust plants. Glumes unequal, 1- to 3-veined, lanceolate-acuminate, glabrous, the lower 8.5–11.5 mm long, the upper 11.5–13 mm long; lemma, including the bearded callus, 4–5.5 mm long, smooth; column glabrous, 2.5–9 mm long; central awn 2.5–6 cm long, plumose in the upper half to two-thirds but with a naked excurrent tip, the feather ± acute in outline; lateral awns 1–2 cm long, glabrous.

Flowering and fruiting. January, March to May; October.

Distribution and habitat. Northern and Southern Oman, on dry sandy and stony soils, pockets of sand amongst stones and small rocks in wadis, and in sand along roads in desert; common grass, especially after rain. *Altitude*: 50–400 m. Mediterranean region to southwest Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 90; Collenette, l.c., p. 420.

8. ***Stipagrostis hirtigluma*** (Steud. ex Trin. & Rupr.) De Winter in Kirkia 3: 136 (1963).
Synonym. Aristida hirtigluma Steud. ex Trin. & Rupr. (1842).

Description. Annual up to 45 cm high; internodes and leaf-sheaths glabrous or scrabridulous. Panicle contracted although the spikelets are on rather long filiform pedicels. Glumes unequal, narrowly lanceolate, 3-veined, obtuse, the midvein shortly excurrent, hairy on the back, the lower 7.5–9.5 mm long, the upper 10–11.5 mm long; lemma, including the bearded callus, 3–4.5 mm long, papillose-scabrid; callus with 2 collars of hairs, the lower, just behind the naked tip, with very short hairs all about the same length, the upper, at the summit of the callus, with hairs about half as long as the body of the lemma, the callus naked between the collars; column pilose, especially towards the junction of the awns, 7–13 mm long; central awn 4–7 cm long, plumose throughout except for the naked excurrent tip, sometimes only thinly hairy below; lateral awns 1–1.6 cm long, glabrous.

Distribution and habitat. Northern Oman, in wadis of foothills of the Western Hajar mountains, on sandy, stony and rocky soils. *Altitude*: 100–450 m. Tropical and southern Africa to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 91; Collenette, l.c., p. 419.

Notes. Hybridizes with Stipagrostis uniplumis; the hybrids are intermediate in callus indumentum and are male-sterile.

9. ***Stipagrostis uniplumis*** (Licht.) De Winter in Kirkia 3: 136 (1963).
Synonym. Aristida uniplumis Licht. (1817).

Description. Tufted perennial, often short-lived, up to 75 cm high; internodes glabrous. Panicle contracted, although the spikelets are on long filiform branches and pedicels. Glumes unequal, narrowly lanceolate, 3-veined, glabrous or thinly hairy, the lower 7–8 mm long, shortly bifid at the tip with the central vein excurrent, the upper 9–10.5 mm long, narrowed above into a short awn; lemma, including the bearded callus, 2.5–3 mm long, papillose-scabrid; column pilose, especially (and sometimes only) at the junction of the awns, 6.5–10 mm long; central awn 3–4 cm long, plumose throughout, sometimes thinly so below, with or without a naked excurrent tip; lateral awns 0.8–1.2 cm long, glabrous.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, on andy, stony and rocky soils. *Altitude*: 50–250 m. Tropical and southern Africa to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 92; Collenette, l.c., p. 421.

Notes. Distinguished from *Stipagrotis hirtigluma* only by the nature of the callus hairs and by the more perennial habit. The hairs on the glumes are not as reliable a means of separation.

10. ***Stipagrostis sokotrana*** (Vierh.) De Winter in Kirkia 3: 136 (1963).
Synonym. Aristida sokotrana Vierh. (1907) — Type: Socotra, *Paulay* (holo. W).

Description. Densely tufted perennial up to 30 cm high, woody and much-branched at the base; internodes glabrous. Panicle contracted. Glumes unequal, thinly hairy on the flanks, coarsely scabrid on the prominent veins, the lower narrowly lanceolate, 5- to 9-veined, 8.5–14 mm long, the upper narrowly lanceolate-acuminate, 3- to 5-veined, 18.5–26 mm long; lemma, including the bearded callus, 5–6.5 mm long, smooth; column glabrous, 8.5–13 mm long; central awn 5.5–7 cm long, plumose in the upper half, glabrous below except for a short pubescence extending upwards for ± 2 mm from the junction of the awns, the tip not excurrent and the feather obtuse in outline; lateral awns 2–2.8 cm long, glabrous.

Flowering and fruiting. February to April; November, December.

Distribution and habitat. Central and Southern Oman, on Jiddat al Harasis and on dry limestone hills in Dhofar, on sandy and gravelly soils. *Altitude*: 150–300 m. Not known elsewhere but widespread in Arabia. Found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 93.

11. ***Stipagrostis paradisea*** (Edgew.) De Winter in Kirkia 3: 135 (1963).
Synonyms. Aristida paradisea Edgew. (1847) – Type: Yemen, *Edgeworth* (K); *Arthratherum caloptilum* Jaub. & Spach (1851) – Type: Yemen, *Botta* (P).

Description. Tufted perennial up to 40 cm high, much-branched at the base; internodes glabrous. Panicle contracted. Glumes unequal, lanceolate-subulate, 3-veined, glabrous, the lower 14–19 mm long, the upper 12–14 mm long; lemma, including the bearded callus, 4–4.5 mm long, smooth; column glabrous, 11–14 mm long; central awn 6–7 cm long, plumose throughout except for the naked excurrent tip; lateral awns 1.6–2.5 cm long, glabrous.

Flowering and fruiting. April; September, October.

Distribution and habitat. Northern and Southern Oman, on limestone hills amongst rocks in pockets of sand. *Altitude*: 300–870 m. Somalia and southwest Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 94; Collenette, l.c., p. 420.

12. ***Stipagrostis xylosa*** Cope in Kew Bull. 47: 660 (1992).

Description. Loosely tufted perennial up to 25 cm high, with a branched woody base; lower leaf-sheaths persistent, tough, not disintegrating into fibres; internodes glabrous. Panicle contracted. Glumes unequal, 3-veined, narrowly lanceolate-acuminate, glabrous, the lower 12–15 mm long, the upper 9–12 mm long; lemmas, including the pungent bearded callus, ± 3.5 mm long, smooth; column glabrous, 4–8 mm long; central awn 3.5–4.5 cm long, plumose in the upper half but with a naked excurrent tip, the feather nevertheless very obtuse in outline; lateral awns 1–1.5 cm long, glabrous.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in sand. *Altitude*: ± 150 m. Also Somalia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 95.

21. **Aristida** L.

About 300 species; cosmopolitan.

1. Lemma or column not articulated at its summit (Sect. Aristida) 2
   Lemma or column articulated at its summit 4
2. All three awns reduced to minute bristles at the summit of the lemma ..... 1. **A. fredscholzii**
   At least the central awn well developed 3
3. Lateral awns absent or much reduced, if up to 13 mm long then bristle-like and much finer than the central; tip of lemma with a semi-circular bend below the column ..... 2. **A. abnormis**
   Lateral awns well developed, similar to the central; lemma straight ..... 3. **A. adscensionis**
4. Articulation of the lemma at the base of the column (Sect. Arthratherum) 5
   Articulation of the lemma at the top of the column, just below the awns (Sect. Pseudarthratherum) ..... 7. **A. mutabilis**
5. Lower glume 3–6 mm longer than the upper ..... 4. **A. funiculata**
   Lower glume half to two-thirds as long as the upper 6
6. Awns unequal, the laterals considerably shorter and thinner than the central ..... 5. **A. triticoides**
   Awns subequal ..... 6. **A. migiurtina**

1. ***Aristida fredscholzii*** H.Scholz & Kürschner in Willdenowia 30: 273 (2000) – Type: Oman, Eastern Hajar, Wadi Muharam south of Sumail, Sumail gap, *Kürschner & Scholz* 99-39 (holo. B).

Description. Annual up to 17 cm high. Panicle sparse, 5–8 cm long. Glumes subequal, narrowly lanceolate, 4–6 mm long; lemma, including the bearded callus, 5.5–9.5 mm long, indistinctly laterally compressed, without a column; central awn reduced to a bristle 0.5–1.5 mm long; lateral awns reduced to barely visible whiskers at the base of the central.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, in wadis, on sandy and stony soils; endemic to Oman and known only from the type specimen. *Altitude*: ± 450 m.

Distribution map & Illustration. 96.

Notes. Probably the most unusual species in the whole genus. It carries to the ultimate the reduction of the awns seen in *A. abnormis*: the central to a short bristle, the laterals to barely detectable lateral points.

2. ***Aristida abnormis*** Chiov. in Pirotta, Fl. Eritrea: 48 (1903).

Description. Annual up to 40 cm high, but usually much less. Panicle loose and open, sometimes contracted but not spike-like. Glumes subequal (the upper fractionally the longer), narrowly lanceolate, 5–7.5 mm long, scabridulous, the lower usually deciduous before the floret is mature; lemma, including the bearded pointed callus and the 4–10 mm column, 12–22 mm long, scabrid, with a semi-circular bend below the column; column without an articulation; central awn 0.7–2.3 cm long; lateral awns up to 1.3 cm long, shorter and sometimes absent altogether.

Flowering and fruiting. February to October.

Distribution and habitat. Northern and Southern Oman, in the foothills of the mountains, on rocky hillsides. *Altitude*: 50–450 m. Northeast Africa and southwest Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 97; Collenette, l.c., p. 344.

3. ***Aristida adscensionis*** L., Sp. Pl. 1: 82 (1753).

Synonyms. A. paniculata Forssk. (1775) – Type: Yemen (N), *Forsskal* (C); *A. pumila* Deene. (1835) – Type: Yemen (N), *Decaisne* (P); *A. ehrenbergii* Trin. & Rupr. (1842) – Type: Arabia, *Ehrenberg* (LE); *A. caerulescens* var. *breviaristata* Schweinf. – Types: Yemen, *Schweinfurth* 26, 323, 683, 981, 1134, 1524 (B, G); *A. caerulescens* var. *arabica* Henrard (1932) – Type: Arabia, not specified; *A. caerulescens* var. *exilis* Schweinf. ex Blatter (1936) – Type: Yemen, *Schweinfurth* 1957 (K).

Description. Annual or short-lived perennial up to 75 cm high (usually much less). Panicle usually contracted about the primary branches, these either spreading or appressed to the main axis. Glumes unequal, linear-lanceolate to lanceolate, the lower 4–8.5 mm long, the upper 7–11.5 mm long; lemma, including the bearded pointed callus, (5–)11.5–17 mm long, laterally compressed, scabrid on the keel and sometimes also on the flanks, passing into the awns without either column or articulation; awns terete, the central (0.7–)1.5–2.5 cm long, the laterals similar or a little shorter.

Flowering and fruiting. April to September.

Distribution and habitat. Throughout Oman, from coastal cliffs to the foothills and mid altitudes of the Hajar mountains, in wadis, and hillsides, amongst rocks and stones; common. *Altitude*: 20–2000 m. Throughout the tropics and subtropics. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 98; Collenette, l.c., p. 345.

4. ***Aristida funiculata*** Trin. & Rupr., Sp. Gram. Stipac.: 159 (1842).

Description. Annual up to 30 cm high. Panicle sparse, contracted, scarcely exserted from the uppermost leaf-sheath. Glumes unequal, linear-lanceolate, long-acuminate, the lower 15–25 mm long, the upper 13–20 mm long; lemma-body, including the bearded pungent

callus, 4–7.5 mm long, terete, smooth, articulated at the summit and bearing a column 2–4.5 cm long; awns subequal, filiform, 4.5–8.5 cm long.

Flowering and fruiting. April, September.

Distribution and habitat. Southern Oman, on open gravelly plains. *Altitude*: 150–250 m. Tropical Africa to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 99; Collenette, l.c., p. 346.

5. ***Aristida triticoides*** Henrard in Meded. Rijks-Herb. 54C: 744 (1933).

Description. Tufted, short-lived perennial up to 40 cm high. Panicle dense, spike-like. Glumes very unequal, minutely 2- toothed and tipped with a short (0.7–2 mm) awn, the lower lanceolate, ± 6.5 mm long, the upper narrowly lanceolate, 14.5–16.5 mm long; lemma-body, including the bearded pungent callus, 3.5–4.5 mm long, terete, smooth, articulated at the summit and bearing a column 1.6–2.2 cm long; awns unequal, the central 5.5–6.5 cm long, the laterals thinner, 4–4.5 cm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on dry rocky slopes of Jebel Qamar. *Altitude*: ± 750 m. Somalia and Pakistan. Elsewhere in the Arabian Peninsula found in Yemen; not confirmed in Saudi Arabia.

Distribution map & Illustration. 100.

6. ***Aristida migiurtina*** Chiov., Pl. Nov. Aethiop.: 29 (1928).

Description. Tufted perennial up to 20 cm high including the awns. Panicle contracted, at least as long as the supporting culm and, with the awns included, comprising most of the height of the plant. Glumes very unequal, minutely 2- toothed and tipped with a short (1–2 mm) awn, the lower lanceolate, 6–13 mm long, the upper narrowly lanceolate, 12–22 mm long; lemma-body, including the bearded pungent callus, 4.5–5.5 mm long, terete, smooth, articulated at the summit and bearing a column 1.5–2 cm long; awns unequal, the central 6.5–8 cm long, the laterals thinner, 5–6 cm long.

Flowering and fruiting. July.

Distribution and habitat. Northern and Southern Oman, in the Jebel Akhdar range in northern Oman, and on rocky plateau in Dhofar, amongst rocks and in rock crevices. *Altitude*: 200–1800 m. Also Somalia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 101; Collenette, l.c., p. 346.

7. ***Aristida mutabilis*** Trin. & Rupr., Sp. Gram. Stipac.: 150 (1842).

Synonyms. A. meccana Hochst. ex Trin. & Rupr. (1842) — Type: Saudi Arabia, *Schimper*

(LE); (1842); *A. schweinfurthii* var. *boissieri* Schweinf. (1894) - Types: Yemen, *Schweinfurth* 94 (K) and Eritrea.

Description. Annual up to 35 cm high. Panicle open or contracted, the spikelets clustered at the tips of the branches. Glumes unequal, lanceolate, acute, acuminate or shortly 2- toothed and tipped with a mucro or awnlet up to 1 mm long, the lower 3.5–5.5 mm long, the upper 5.5–7 mm long; lemmas, including the bearded pointed callus, 5–8 mm long, terete, smooth, narrowed above into a column a little less than half the total length of the lemmas, the column articulated at the summit; awns slender, 1.5–2.5 cm long.

Flowering and fruiting. February to May.

Distribution and habitat. Northern Oman, in wadis, stony and sandy plains, and around irrigation; a common grass, grazed by all livestock. *Altitude*: 30–350 m. Tropical Africa to India. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 102; Collenette, l.c., p. 347.

Tribe X. PAPPOPHOREAE Kunth

22. **Enneapogon** P. Beauv.

Twenty-four species; tropical and warm temperate areas of the world.

1. Third lemma vestigial, 0.3–2(–3.5) mm long including the awns 2
   Third lemma well developed (and often accompanied by a vestigial fourth), 2.5–9(–10.5) mm long including the awns 3
2. Anthers 0.4–0.8(–1.2) mm long; densely tufted annual or perennial, the culms often covered at the base in old leaf-sheaths, these usually disintegrating into fibres ..... 1. **E. desvauxii**
   Anthers 1–1.7 mm long; loosely tufted annual, the base not covered in old sheaths or fibres ..... 2. **E. cenchroides**
3. Fertile lemma sparsely to densely hairy on the back, the hairs evenly distributed ..... 3. **E. persicus**
   Fertile lemma with 3 dense patches of hairs on the back, one along the midvein and one along each margin ..... 4. **E. lophotrichus**

1. ***Enneapogon desvauxii*** P.Beauv., Ess. Agrostogr.: 82, t. 16 11 (1812).

Synonyms. Pappophorum phleoides Trin. (1821) – Type: Saudi Arabia (no further details); *P. brachystachyum* Jaub. & Spach. (1851) – Type: Yemen, *Botta* (P); *P. arabicum* Hochst. & Steud. (1854) – Type: Saudi Arabia, *Schimper* (TUB).

Description. Tufted perennial, or sometimes annual, up to 18 cm high; basal leaf-sheaths persistent, forming a pseudobulbous base to the culm and usually ultimately disintegrating into a tuft of fibres. Panicle densely contracted, spike-like. Lower glume 7-veined, 1.8–3.5 mm long; upper glume 5-veined, 2–4.5 mm long; fertile lemma 3.4–6 mm long (including

the awns), hairy on the back all over; awns ciliate; anthers 0.4–0.8(–1.2) mm long; third lemma vestigial, 0.3–0.8 mm long including the awns.

Flowering and fruiting. March to May.

Distribution and habitat. Northern Oman, in wadis, on sandy and stony soils. *Altitude*: 50–1800 m. Africa to India and China; Central & South America. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen, UAE; also found on Soqotra.

Distribution map & Illustration. 103; Collenette, l.c., p. 375.

2. ***Enneapogon cenchroides*** (Roem. & Schult.) C.E.Hubb. in Bull. Misc. Inform. 1934: 119 (1934).
Synonym. Pappophorum cenchroides Roem. & Schult. (1817).

Description. Annual up to 75 cm high; basal leaf-sheaths remaining intact. Panicle loosely contracted, often lobed at the base. Lower glume 5- to 7-veined, 2.6–3.8 mm long; upper glume 3-veined, 3.5–5 mm long; fertile lemma 4–7 mm long (including the awns), hairy on the back all over; awns ciliate; anthers 1–1.7 mm long; third lemma vestigial, occasionally well developed (but barren), 0.3– 2(–3.5) mm long.

Flowering and fruiting. January, February.

Distribution and habitat. Northern Oman, in agricultural land on stony ground. *Altitude*: ± 450 m. Africa and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 104; Collenette, l.c., p. 375.

3. ***Enneapogon persicus*** Boiss., Diagn. Pl. Orient. 1(5): 71 (1844).
Synonyms. Pappophorum persicum (Boiss.) Steud. (1854); *Enneapogon elegans* (Nees ex Steud.) Stapf (1907).

Description. Tufted perennial up to 50 cm high; basal leaf-sheaths remaining intact. Panicle loosely or densely contracted, spike-like or lobed. Glumes often deeply suffused with purple, the lower 7-veined, 3.5–7.5(–10) mm long, the upper 7-veined, 4.5–10.3 mm long; fertile lemma 6–13 mm long (including the awns), hairy on the back all over; awns ciliate; anthers 0.6–1 mm long; third lemma often well developed (but barren), 2.5–9(–10.5) mm long including the awns, sometimes accompanied by a vestigial fourth lemma.

Flowering and fruiting. March, April.

Distribution and habitat. Northern Oman, in the Western Hajar mountains, on rocky hillsides. *Altitude*: 500–1600 m. Tropical Africa; south & southwest Asia to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 105; Collenette, l.c., p. 376.

Notes. E. schimperianus (Hochst ex A.Rich.) Renv. and *E. persicus* have now been united. They form a continuum with no obvious means of partition other than a suggestion of a geographical segregation; plants with smaller spikelet parts are mostly African whilst those

with larger parts are mostly Asiatic, but the two sorts overlap considerably, particularly in Arabia. *E. elegans* from India also belongs here.

4. ***Enneapogon lophotrichus*** Chiov. ex H.Scholz & P.König in Willdenowia 13: 369 (1983).

Synonym. Pappophorum molle auct. non (Lehm.) Kunth.

Description. Annual up to 20 cm high; basal leaf-sheaths remaining intact. Panicle loosely contracted, oblong. Glumes often flushed with pink, the lower 7- to 9-veined, 3.5–5 mm long, the upper 5- to 7-veined, 5–7 mm long; fertile lemma 6–7.5 mm long (including the awns), hairy on the back in 3 dense patches, one along the midvein and one along each margin; awns ciliate; anthers 0.3–0.5 mm long; third lemma well developed (but barren), 3.2–5.3 mm long including the awns, usually accompanied by a vestigial fourth lemma.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, on the Western Harjar mountains, on rocky hillsides. *Altitude*: 500–1600 m. Ethiopia, Somalia and Egypt. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 106; Collenette, l.c., p. 376.

Tribe XI. ERAGROSTIDEAE Stapf

1. Spikelets 2- to several-flowered, if 1-flowered then the inflorescence either a solitary raceme or composed of several racemes arranged along an axis 2
   Spikelets strictly 1-flowered; inflorescence an open or spike-like panicle 15
2. Lemmas 9- to 11-veined ..... 24. **Aeluropus**
   Lemmas 3-veined or becoming 5- to 7-veined in the upper half (sometimes with 1 or more subsidiary veins present on either side of the keel in 72. *Eleusine*) 3
3. Inflorescence a spike-like panicle with sterile spikelets at the base; lemmas shortly awned, 3-veined below, becoming 5- to 7-veined in the upper half; only the lowermost floret of each spikelet fertile, the remainder male or barren ..... 23. **Fingerhuthia**
   Inflorescence mostly of 1 to several racemes, sometimes a panicle, but if a spike-like panicle then lemmas 3-veined throughout and lowermost spikelets not sterile 4
4. Caryopsis strongly flattened, concavo-convex, with a free pericarp ..... 32. **Coelachyrum**
   Caryopsis seldom flattened and then not with a free pericarp 5
5. Inflorescence a solitary raceme, this not deciduous; spikelets glabrous 6
   Inflorescence of 2 or more racemes, or a panicle 7
6. Spikelets 1-flowered, ± embedded in the axis ..... 26. **Oropetium**
   Spikelets 2-or more-flowered, not embedded in the axis ..... 25. **Tripogon**
7. Inflorescence a narrow panicle, up to 26 cm long (tough stoloniferous perennial

with robust stolons, forming dense tussocks; culms up to 1.5(–2) m, rigid, woody, branching to produce clusters of shoots at the nodes) ..... 27. **Halopyrum**
Inflorescence an open or narrow spicate panicle, or of 2 or more racemes 8
8. Racemes persistent 9
Racemes deciduous 11
9. Lower glume much longer than the lowermost lemma ..... 28. **Trichoneura**
Lower glume not exceeding the lowermost lemma 10
10. Glumes as long as the spikelet, enclosing the florets; racemes arranged along a central axis ..... 29. **Dinebra**
Glumes not or scarcely exceeding the adjacent lemmas; racemes digitate ..... 30. **Ochthochloa**
11. Inflorescence an open or narrow spicate panicle, very rarely of racemes along an axis..... 31. **Eragrostis**
Inflorescence of several racemes 12
12. Racemes terminating in a rigid naked point ..... 35. **Dactyloctenium**
Racemes terminating in a fertile or abortive spikelet 13
13. Racemes arranged on a long central axis ..... 36. **Desmostachya**
Racemes digitate or ± whorled 14
14. Lemma tip awnless and the lateral veins not excurrent; rhachilla fragile, the spikelets disarticulating between the florets ..... 33. **Eleusine**
Lemma tip awn-pointed and the lateral veins slightly excurrent; rhachilla tough, the lemmas disarticulating leaving the persistent paleas ..... 34. **Acrachne**
15. Spikelets fusiform, glabrous; glumes and lemmas rounded on the back; fruit without a beak ..... 37. **Sporobolus**
Spikelets strongly laterally compressed, shortly hairy; glumes and lemmas keeled; fruit with a conspicuous beak ..... 38. **Urochondra**

23. **Fingerhuthia** Nees

Two species; Africa, Arabian Peninsula, Afghanistan to Pakistan.

Fingerhuthia africana Lehm., Sem. Hort. Bot. Hamburg. 1834: 7 (1834) and in Linnaea 10, Litt.: 112 (1836).

Synonym. F. africana var. *minor* (Nees) Pilg. ex Schwartz (1939).

Vernacular names: dukhnīiyah, makwaybah (Arabic).

Description. Densely tufted perennial, up to 40 cm high. Panicle purplish, narrowly ovoid, 1–4 × 0.6–1 cm, the base truncate with few sterile spikelets, or tapered and with many. Ligule a line of hairs. Spikelets falling entire, comprising 1 fertile floret with 1–3 smaller male or barren florets above. Glumes awned, 4–6.5 mm long including the 1–2.5 mm awn, ciliate on the keel; fertile lemma 3–5.8 mm long including the short awn-point, 3-veined below, becoming 5- or 7-veined in upper half.

Flowering and fruiting. March, April.

Distribution and habitat. Northern Oman, on the Jebal Akhdar range, on rocky hillsides and in crevices of rocks. *Altitude*: 2000–2200 m. Southern Africa, Afghanistan and Pakistan; introduced in Australia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 107; Collenette, l.c., p. 384.

24. **Aeluropus** Trin.

Six species; Mediterranean region to Mongolia, Sahara to Indian Subcontinent.

Aeluropus lagopoides (L.) Trin. ex Thwaites, Enum. Pl. Zeyl.: 374 (1864).
Synonym. Dactylis lagopoides L. (1753).
Vernacular names: akaresh, ailah, qidqidhair (Arabic).

Description. Perennial; sub-shrubby or sward-forming, with long creeping stolons, up to 15(–30) cm high; leaf-blades narrow, spreading, subdistichous, soft and tapering or, more usually, distichous, rigid and pungent, hairy or glabrous; ligule a very short membrane fringed with hairs. Inflorescence a globose, ellipsoid or oblong head, sometimes reduced to a solitary raceme of closely crowded spikelets, (0.5–)1–2(–2.5) × (0.5)1–1.5 cm. Spikelets elliptic-oblong, 4- to 8-flowered, 2.5–4.5 mm long; glumes shorter than the lemmas, elliptic, unequal, villous, the lower 1.4–1.7 mm long, 1- to 3-veined, the upper 1.8–2.2 mm long, 5- to 7-veined; lemmas broadly elliptic, rounded on the back, apiculate, 2.4–2.8 mm long, chartaceous, strongly 9- to 11-veined, villous on the margins.

Flowering and fruiting. January to May; September, October.

Distribution and habitat. Throughout Oman, in arid localities, in shallow depressions, on sandy and silty soils, sabkhas, mangrove swamps, near water-holes, in cultivated areas and waste places. *Altitude*: 0–250 m. Mediterranean region, eastwards to India. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 108; Collenette, l.c., p. 342.

25. **Tripogon** Roem. & Schult.

Forty-five species; Africa, Asia, Australasia, North and South America.

1. Spikelets strictly 2-flowered; florets ± enclosed by the glumes ..... 6. **T. africanus**
   Spikelets 3- to 18-flowered; florets exceeding the glumes 2
2. Anthers 2, 0.2–0.5 mm long ..... 1. **T. subtilissimus**
   Anthers 2 or 3, 0.9–1.8 mm long 3
3. Anthers 2; lemmas with mid vein excurrent into a flexuous capillary awn several times longer than the body; lateral veins excurrent into capillary awns about as long as the body ..... 2. **T. capillatus**

Anthers 3; lemmas with mid vein excurrent for no more than twice the length of the body, usually straight; lateral veins excurrent for no more than 1 mm 4

4. Palea keels conspicuously winged; spikelets (5–)9- to 18-flowered .. 3. **T. multiflorus**

Palea keels wingless or if very narrowly winged then base of plant clothed in a cushion of persistent regular fibres; spikelets (2–)3- to 8-flowered 5

5. Midvein of lemma produced as a short awn-point mostly less than 1 mm long; lateral veins not excurrent or produced into mucros up to 0.2 mm long ..... 4. **T. purpurascens**

Midvein of lemma produced as an awn 2–8 mm long; lateral veins excurrent for 0.4–1.1 mm ..... 5. **T. leptophyllus**

1. ***Tripogon subtilissimus*** Chiov. in Ann. Bot. (Rome) 5: 66 (1906).

Description. Tufted perennial up to 23 cm; basal leaf-sheaths persistent, eventually disintegrating into coarse fibres. Raceme 3.5–9.5 cm long, flexuous or curved. Spikelets 4.3–8.5 mm long, 5- to 11-flowered; lower glume 1–1.7 mm long; upper glume 2.5–3.1 mm long; lemmas 1.7–2.6 mm long, 2- toothed at the tip, the midvein excurrent into an awn 0.8–1.4 mm long, the lateral veins excurrent for 0.1–0.3 mm; palea keels distinctly winged; anthers 2, 0.2–0.5 mm long.

Flowering and fruiting. July.

Distribution and habitat. Southern Oman, Dhofar, on Jebel Qamar, in wadis, on rocky ground. *Altitude*: ± 600 m. Eastern tropical Africa. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 109.

Notes. The only Arabian species with two extremely short anthers; most of the others have three much longer anthers (only two in *T. capillatus*, but much longer than in *T. subtilissimus*).

2. ***Tripogon capillatus*** Jaub. & Spach, Ill. Pl. Orient. 4: 47, t. 332 (1851).

Description. Tufted perennial up to 55 cm high; basal leaf-sheaths persistent, eventually decaying into fibres. Raceme 20–35 cm long, curved or flexuous. Spikelets 6–7 mm long, 3- to 4-flowered; lower glume 2.5–4.5 mm long; upper glume 6–9 mm long including the awn; lemmas 2.8–3.8 mm long, 2- toothed at the tip, the midvein excurrent into a flexuous capillary awn up to 25 mm long, the laterals excurrent for up to 8 mm; palea keels wingless; anthers 2, 0.9–1.2 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, Jebel Qamar, in escarpment woodland. *Altitude*: ± 700 m. Also India. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 110.

3. ***Tripogon multiflorus*** Miré & H. Gillet in J. Agric. trop. Bot. Appl. 3: 737 (1956).

Description. Densely tufted perennial up to 40 cm high; basal leaf-sheaths usually persistent. Raceme 11– 15 cm long, stiff and usually straight. Spikelets (7.5–)11–18 mm long, (5–)9- to 18-flowered; lower glume 1.6–3 mm long; upper glume 2.7–3.6 mm long; lemmas 2.9–3.4 mm long, bluntly 2- toothed at the tip, the midvein excurrent into an awn 0.8–2 mm long, the laterals scarcely excurrent (up to 0.3 mm); palea keels distinctly winged; anthers 3, 0.9–1.4 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on Jebal Qara, on rocky hillsides. *Altitude*: ± 550 m. Saharan mountains and eastern tropical Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 111; Collenette, l.c., p. 425.

Notes. Distinguished from *T. leptophyllus* by the more pronounced wings on the palea keels. The wings are present in *T. leptophyllus*, but high magnification or a very sharp eye are needed to see them properly. *T. multiflorus* has a broader, stiffer raceme than *T. leptophyllus* and usually lacks the characteristic cushion of fibres at the base.

4. ***Tripogon purpurascens*** Duthie in Ann. Roy. Bot. Gard. (Calcutta) 9: 74, t. 92 (1901).
Vernacular names: duqayqa (Arabic).

Description. Densely tufted perennial up to 27 cm high; basal leaf-sheaths persistent, eventually disintegrating into a cushion of coarse fibres. Raceme 8–13 cm long, usually straight. Spikelets 4.8–5.5 mm long, 3-flowered (2- to 5-flowered outside Arabia); lower glume 1.6–2.1(–2.7) mm long; upper glume 3.1–4.4 mm long; lemmas 2.6–3.5 mm long, bluntly 2- toothed at the tip, the midvein excurrent as a mucro or awn-point 0.1–0.9 mm long, the laterals not excurrent; palea keels wingless; anthers 3, 0.9–1.5 mm long.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, on Jebel Akhdar, on summit of Jebal Shams, on rocky slope. *Altitude*: ± 3000 m. Afghanistan, Pakistan and northwest India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 112; Collenette, l.c., p. 426.

5. ***Tripogon leptophyllus*** (A. Rich.) Cufod., Enum. Pl. Aethiop.: 1269 (1968).
Synonym. Danthonia leptophylla A.Rich. (1850).

Description. Densely tufted perennial up to 35 cm high; basal leaf-sheaths disintegrating into a persistent cushion of fine, regular fibres. Raceme 12–16 cm long, flexuous. Spikelets 5.5–8.5 mm long, 5- to 8-flowered; lower glume ± 3 mm long; upper glume 4–5.5 mm long; lemmas 3.6–3.8 mm long, bluntly 2- toothed at the tip, the midvein excurrent into

an awn 2–3 mm long, the laterals excurrent for up to 1 mm; palea keels inconspicuously winged; anthers 3, ± 1 mm long.

Distribution and habitat. Southern Oman, Dhofar, in damp pockets of soil on limestone pavement in *Anogeissus* forest. *Altitude*: 500–600 m. Sudan and Ethiopia. Elsewhere in the Arabian Peninsula found in Yemen.

Flowering and fruiting. September.

Notes. The wings on the palea keels are scarcely apparent except under high magnification. The species is best distinguished by the basal cushion of persistent fibres derived from disintegrating leaf-sheaths.

Distribution map & Illustration. 113.

6. ***Tripogon africanus*** (Coss. & Durieu) H. Scholz in Willdenowia 14: 376 (1984).
Synonym. Kralikia africana Coss. & Durieu (1867).

Description. Tufted perennial up to 15 cm high; basal leaf-sheaths persistent, eventually disintegrating into coarse fibres. Raceme 6–10 cm long, straight or slightly flexuous. Spikelets 3.4–4 mm long, 2-flowered; lower glume 1–1.5 mm long; upper glume 3–3.5 mm long; lemmas 2.4–3 mm long, bluntly 2- toothed at the tip, the midvein excurrent for 0.2–0.3 mm, the laterals not excurrent; palea keels wingless; anthers 3, 0.8–1.1 mm long.

Flowering and fruiting. March, April.

Distribution and habitat. Northern Oman, on the Western and Eastern Hajar mountains, on rocky hillsides. *Altitude*: 900–1800 m. North Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration. 114; Collenette, l.c., p. 425.

Notes. An oddment in the genus, but better here than in *Oropetium*.

26. **Oropetium** Trin.
Six species: Africa, Arabian Peninsula, Indian Subcontinent to Indo-China.

Oropetium capense Stapf in Dyer, Fl. Cap. 7: 742 (1900).
Synonym. O. capense var. *arabicum* H. Scholz & P. König (1984) Type: Saudi Arabia, *Baierle et al.* 82-229a (holo., B).

Description. Small tufted perennial, rarely annual, to 6 cm high; ligule membranous with a ciliate margin. Inflorescence a single straight or coiled raceme, the spikelets in two opposite, subopposite or adjacent ranks, ± sunk in the rhachis, this tough or fracturing into segments of 1–4(–8) spikelets. Spikelets 1-flowered, with or without a minute rhachilla extension concealed in the callus hairs, dorsally compressed, edgeways to the rhachis; lower glume obscure or absent; upper glume exceeding and concealing the floret, coriaceous, 1- to 3-veined, acute to awned; lemma 1.5–2.5 mm long, lightly keeled, hyaline, glabrous to pilose, obscurely mucronulate.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar on the mountains, on rocky hillsides. *Altitude*: 700–850 m. Tropical and southern Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 115; Collenette, l.c., p. 393.

27. **Halopyrum** Stapf

Single species; Egypt to Mozambique, Madagascar, Arabian Peninsula to Indian Subcontinent.

Halopyrum mucronatum (L.) Stapf in Hook., Icon. Pl. 25: t. 2448 (1896).
Synonym. Desmazeria unioloides Deflers (1889), nom. superfl., based on *Uniola mucronata* L. (1753).

Description. Tough stoloniferous perennial with robust stolons, forming dense tussocks; culms up to 1.5(–2) m high, rigid, woody, branching to produce clusters of shoots at the nodes; leaf-blades narrowly linear to setaceous, stiff, glaucous; ligule a line of hairs. Panicle narrow, up to 26 cm long. Spikelets 8- to 16-flowered, 1.5–2 cm long; glumes 3- to 7-veined, 6.5–9.5 mm long, coriaceous, acute; lemmas 7.5–8.5 mm long, the callus and rhachilla tip bearded with hairs 3–5 mm long.

Flowering and fruiting. January, February; September, October.

Distribution and habitat. Throughout Oman, on coastal dunes above the high tide mark, on saline sand. Coastal Indian Ocean from Mozambique to Sri Lanka. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 116; Collenette, l.c., p. 385.

28. **Trichoneura** Andersson

Eight species; Africa, temperate Asia.

Trichoneura mollis (Kunth) Ekman in Ark. Bot. 11(9): 10 (1912).
Synonyms. Leptochloa mollis Kunth (1831); *Uralepis arenaria* Steud. (1854) – Type: Saudi Arabia, *Schimper* 808 (syntypes, P, K).

Description. Slender annual up to 50 cm high. Inflorescence 5–25 cm long, compact with stiff ascending racemes 1.5–5 cm long. Spikelets 5- to 9-flowered, 6.2–8 mm long, green or tinged with red; glumes as long as or exceeding the florets, caudate; lemmas oblong, 2.5–3.5 mm long, ciliolate on the lateral veins, sparsely hairy on the back; awn 6–20 mm long; palea glabrous or capitate-pilose.

Flowering and fruiting. February, March.

Distribution and habitat. Northern Oman, and Musandam, on sandy and stony soils. *Alti-*

tude: 0–150 m. Also Senegal and Mauritania, eastwards to the Red Sea coast, and Somalia. Elsewhere in the Arabian Peninsula found in Saudi Arabia; also found on Soqotra.

Distribution map & Illustration. 117; Collenette, l.c., p. 424.

Notes. Saudi Arabian specimens have a glabrous palea whereas those from Oman have a palea that is capitate-pilose between the keels. The former condition is typical of specimens from the Nubian coast while the latter is closer to material from Somalia southwards to Kenya.

29. **Dinebra** Jacq.
Seven species; Africa to India, Andaman and Nicobar Is., S Pacific.

Dinebra retroflexa (Vahl) Panz. in Denkschr. Königl. Akad. Wiss. München 1813: 270, t. 12 (1814).
Synonym. Cynosurus retroflexus Vahl (1791).
Vernacular name: na'amayt (Jibbālī).

Description. Loosely tufted annual, up to 50 cm high; culms slender, usually straggling and ascending from a decumbent base, much-branched and rooting from the lower nodes. Inflorescence 8.5–17(–22) cm long, linear, with short, oblong, densely crowded racemes, varying to elliptic-oblong or pyramidal with longer racemes up to 3 cm apart; racemes 1–2.5(–5) cm long, stiff, ascending at first, eventually reflexing and finally deciduous. Spikelets 1- to 3-flowered, 5–6.5(–9) mm long; glumes coriaceous, asymmetric, overlapping abaxially and obscuring the florets; lemmas narrowly ovate, 1.8–2.4 mm long, appressed-pubescent along the lateral veins and on the back below.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in wadis in shallow depressions, in shaded locations. *Altitude*: ± 350 m. Tropical Africa to Southwest Asia and India. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen.

Distribution map & Illustration. 118; Collenette, l.c., p. 371.

30. **Ochthochloa** Edgew.
A single species; Sahara to NW India.

Ochthochloa compressa (Forssk.) Hilu in Kew Bull. 36: 560 (1981).
Synonyms. Panicum compressum Forssk. (1775) – Type: Yemen, *Forsskal* (holo. C); *Eleusine arabica* Hochst. ex Steud. (1854) – Type: Saudi Arabia, *Schimper* 800 (holo. K); *E. compressa* (Forssk.) Asch. & Schweinf. ex C. Chr. (1922).

Description. Sprawling plant with stolons up to 1 m long and prostrate or ascending culms up to 40 cm high; leaf-blades glaucous, flat or inrolled, short, stiff and pungent; ligule a short membrane with a long ciliate fringe. Racemes 2–4 cm long. Spikelets 3- to 8-flow-

ered, 6–8 mm long, strongly laterally compressed, disarticulating above the glumes but not between the florets; lower glume 2.5–3 mm long; upper glume 3.6–5.6 mm long, with a thickened 3-veined keel; lemmas 4–5.6 mm long.

Flowering and fruiting. March to May.

Distribution and habitat. Northern and Central Oman, in wadis, depressions, on sandy and sandy gravelly soils and amongst gravel and stones. *Altitude*: 50–450 m. Northeast Africa to Northwest India. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 119; Collenette, l.c., p. 392.

31. **Eragrostis** Wolf

About 414 species; cosmopolitan.

1. Palea keels tuberculate-ciliate, the cilia protruding from the margins of the lemmas ... 2
   Palea keels glabrous or scabrid ... 4
2. Panicle contracted, spike-like or lobed and interrupted, the spikelets densely crowded ... 1. **E. ciliaris**
   Panicle loose and open ... 3
3. Plant sticky from glands in the panicle and on the leaf-sheaths to which grains of sand and other debris adhere ... 2. **E. viscosa**
   Plant glandular but not sticky ... 3. **E. amabilis**
4. Lemmas semi-ovate in profile, with straight keel and gibbous margins . 4. **E. patula**
   Lemmas oblong with ± parallel keel and margins or elliptic with ± equally curved keel and margins ... 5
5. Spikelets shedding their florets from the tip downwards, the rhachilla internodes falling with the florets; plant not forming a spiny cushion or small bush ... 6
   Spikelets shedding their florets from below upwards, the rhachilla remaining on the pedicel (or eventually breaking up) ... 7
6. Ligule a membrane; lemmas 0.7–1 mm long ... 5. **E. japonica**
   Ligule a line of hairs; lemmas 1.1–1.5 mm long ... 6. **E. aspera**
7. Palea falling at about the same time as the lemma leaving the naked zig-zag rhachilla; plant not forming a spiny cushion or small bush ... 8
   Palea persistent on the rhachilla long after the lemma has fallen (sometimes the rhachilla disarticulating above the glumes at an early stage with most of the florets still attached, or the upper part becoming fragile once the lemmas have begun to fall) ... 9
10. Spikelets linear to narrowly oblong, up to 1.2 mm wide ... 7. **E. pilosa**
    Spikelets broadly ovate to oblong or rotund, 2.5–4 mm wide ... 8. **E. unioloides**
9. Glaucous perennial forming spiny cushions or small bushes; leaves distichous with stiff pungent blades; culms clothed in imbricate leaf-sheaths ... 9. **E. mahrana**

Annual or perennial, but not forming spiny cushions or small bushes 10
10. Short-lived perennial with stiff glaucous leaves often forming a basal cushion ..... 10. **E. papposa**
Coarse or delicate annual; leaves mostly soft and green, not forming a basal cushion 11
11. Caryopsis subrotund in outline, 0.4–0.6 mm in diameter; leaf-blade margins with or without crateriform glands ..... 11. **E. cilianensis**
Caryopsis broadly oblong to elliptic-oblong in outline, 0.6–1.6 mm long 12
12. Leaf-blades with crateriform glands along the margins ..... 12. **E. minor**
Leaf-blades without crateriform glands along the margins ..... 13. **E. barrelieri**

1. ***Eragrostis ciliaris*** (L.) R. Br. in Tuckey, Narr. Exped. Zaire, app. 5: 478 (1818).
Synonyms. Poa ciliaris L. (1759); *Eragrostis arabica* Jaub. & Spach (1851) – Type: Saudi Arabia, *Schimper* 798 (syntypes BM, K); *E. ciliaris* var. *brachystachya* Boiss. (1884) – Type: Arabia, *Schweinfurth* 1091 (syntypes G) and Pakistan.

Description. Annual up to 50 cm high; leaf-blades flat. Panicle 1–12.5 cm long, contracted, spike-like or lobed and interrupted. Spikelets oblong-elliptic to ovate, 2–3.5 mm long, 6- to 12-flowered, the florets loose and divergent, covered by the spreading palea hairs, disarticulating between the florets, rhachilla fragile; glumes equal, lanceolate, 0.9–1.4 mm long; lemmas oblong in profile, thinly membranous, 0.9–1.5 mm long, with a few pectinate hairs on the lower part of the keel at least in the upper florets, broadly obtuse, mucronate; palea keels pectinate-ciliate with tubercle-based hairs 0.4–0.8 mm long.

Flowering and fruiting. April; September.

Distribution and habitat. Northern and Southern Oman, in wadis, coastal areas, cultivated land, on sandy and stony soils. *Altitude*: 50–300 m. Distributed throughout the tropics. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 120; Collenette, l.c., p. 379.

2. ***Eragrostis viscosa*** (Retz.) Trin., Gram. Gen.: 397 (1830).
Synonym. E. plumosa auct. non (Retz.) Link.

Description. Sticky annual up to 40 cm high, glandular below the nodes; leaf-sheaths hairy, sticky along the margins and keel and around the collar; leaf-blades flat, sticky along the midvein below. Panicle 5–15 cm long, ovate to narrowly oblong in outline, with sticky yellow glandular patches on the axis and branchlets. Spikelets oblong-elliptic, 1.5–4.5 mm long, 5- to 15-flowered, the florets loose and divergent, disarticulating between the florets, the rhachilla fragile; glumes subequal, broadly oblong, 0.6–1.2 mm long, with thickened yellow glandular keel; lemmas oblong in profile, thinly membranous, 0.7–1.4 mm long, broadly obtuse; palea keels pectinate-ciliate with tubercle-based hairs 0.1–0.3(–0.5–) mm long.

Flowering and fruiting. October.

Distribution and habitat. Southern Oman, Dhofar, in semi-desert and wooded mountain slopes. *Altitude*: 20–750 m. Distributed from tropical Africa eastwards to Indo-China and the Philippines. Elsewhere in the Arabian Peninsula found on Soqotra.

Distribution map & Illustration. 121.

Notes. Very similar to both *E. tenella* and *E. lepida* (the latter found only in Saudi Arabia and Soqotra) but distinguished by the numerous glands on the leaves and in the panicle that exude a sticky substance to which grains of sand and other debris readily adhere.

3. ***Eragrostis amabilis*** (L.) Wight & Arn., Cat. Indian Pl. 2: 105 (1834).
Synonyms. Poa amabilis L. (1753); *Eragrostis tenella* (L.) P. Beauv. ex Roem. & Schult. (1817).

Description. Annual up to 40 cm high; leaf-blades flat, not sticky. Panicle 4–9 cm long, elliptic to triangular in outline, loose and open, with glandular patches on the branches but not sticky. Spikelets oblong-ovate, 1.5–2.3 mm long, 4- to 6(–8)-flowered, the florets loose and divergent, disarticulating between the florets, the rhachilla fragile; glumes subequal, ovate, 0.6–0.9 mm long, obtuse or subacute; lemmas ovate in profile, thinly membranous, 0.7–1.1 mm long, rounded at the tip; palea keels pectinate-ciliate with slender tubercle-based hairs 0.1–0.3 mm long.

Flowering and fruiting. January, April; September.

Distribution and habitat. Northern and Southern Oman, in and around cultivated areas, on sandy soil and as a weed of irrigated areas. *Altitude*: 50–300 m. Distributed throughout the tropics. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 122.

Notes. One of a group of closely related species (1–3 in this account) of which only one, *E. ciliaris*, is immediately obvious by its condensed, spike-like panicle. *E. amabilis* has the smallest spikelet parts and both glumes and lemmas are ovate. *E. viscosa* is covered in sticky glands. Intermediates between *E. amabilis* and *E. viscosa* are occasionally found and can be difficult to place correctly.

4. ***Eragrostis patula*** (Kunth.) Steud. Momencl. Bot. ed. 2, 1: 564 (1840).
Synonyms. Poa patula Kunth (1816); *Eragrostis tenuifolia* (A. Rich.) Hochst. ex Steud. (1854).

Description. Tufted perennial up to 90 cm high; basal leaf-sheaths strongly compressed and keeled; leaf-blades flat or folded. Panicle 7–25 cm long, open, triangular in outline with divaricate branches, often simple above. Spikelets linear, dark olive-green, 5–16 mm long, 5- to 16-flowered, the florets spreading and imparting a conspicuously serrate outline, shedding their lemmas from below upwards, the paleas persistent on the tough rhachilla; glumes very small, lanceolate, the lower 0.4–0.75 mm long, the upper longer (0.7–0.9 mm) but scarcely

reaching to the base of the adjacent lemmas; lemmas semi-ovate in profile with straight keel and gibbous margins, membranous, 1.8–2.2 mm long, subacute; palea keels scabridulous.

Flowering and fruiting. October.

Distribution and habitat. Southern Oman, Dhofar, on damp mountain grassland. *Altitude*: ± 1800 m. Widespread in the tropics. Elsewhere in the Arabian Peninsula found in Yemen; reported from Saudi Arabia but remains unconfirmed.

Distribution map & Illustration. 123.

5. ***Eragrostis japonica*** (Thunb.) Trin., Gram. Gen.: 405 (1830).
Synonym. Poa japonica Thunb. (1784).

Description. Annual or short-lived perennial up to 1.5 m high; ligule membranous; leaf-blades flat. Panicle 5–55 cm long, very variable in shape, ranging from linear and contracted to loose and open with ascending branches, the branches solitary or whorled. Spikelets elliptic to narrowly oblong, 1.3–3 mm long, 4- to 14-flowered, disarticulating between the florets, the rhachilla fragile; glumes subequal, narrowly ovate, 0.5–0.8 mm long, subacute to obtuse; lemmas broadly oblong-elliptic in profile, thinly membranous, 0.7–1 mm long, broadly obtuse; palea keels smooth or scabrid.

Flowering and fruiting. September.

Distribution and habitat. Southren Oman, Dhofar, a weed of irrigated sandy fields. *Altitude*: 250–700 m. Tropical Africa to Southeast Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; unconfirmed in the UAE.

Distribution map & Illustration. 124; Collenette, l.c., p. 379.

Notes. A very widespread complex of numerous intergrading forms that, surprisingly, has only been collected on a few occasions in Arabia. The membranous ligule is confined to *E. japonica* in Arabia, and this species and its allies have sometimes been treated as a separate genus, *Diandrochloa* De Winter, on this basis.

6. ***Eragrostis aspera*** (Jacq.) Nees, Fl. Afr. Austral. Ill. 1: 408 (1841).
Synonym. Poa aspera Jacq. (1776).

Description. Coarse annual up to 1.1 m high; leaf-blades flat. Panicle 10–50 cm long, elliptic to ovate in outline, open to very diffuse, the spikelets distant on long capillary pedicels, the branches solitary or whorled. Spikelets oblong to linear, 3–8 mm long, 5- to 20-flowered, disarticulating between the florets, the rhachilla fragile, but sometimes a few lemmas falling before their palea; glumes subequal, oblong-lanceolate, 0.8–1.4 mm long, obtuse; lemmas broadly elliptic in profile, membranous, 1.1–1.5 mm long, broadly obtuse to truncate; palea keels scabrid.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in gravelly wadis and cultivated fields.

Altitude: 50–250 m. Distributed in tropical and southern Africa to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 125; Collenette, l.c., p. 377.

7. ***Eragrostis pilosa*** (L.) P. Beauv., Ess. Agrostogr.: 162, 175 (1812).
Synonym. Poa pilosa L. (1753).

Description. Annual up to 75 cm high; leaf blades flat. Panicle 8–30 cm long, lanceolate to narrowly elliptic in outline, the lowermost branches whorled and usually pilose in the axils with a few loose long hairs. Spikelets narrowly oblong, 3–6 mm long, 4- to 12-flowered, shedding their florets from below upwards, the palea falling with or soon after the lemma, the rhachilla tough; glumes very unequal, the lower a minute veinless scale 0.3–0.7 mm long, the upper ovate, 0.9–1.4 mm long; lemmas lanceolate in profile, membranous, 1.2–1.7 mm long, pallid or leaden grey, subacute; palea keels scrabridulous. Caryopsis ellipsoid, slightly laterally compressed, 0.7–0.9 mm long.

Flowering and fruiting. June, July.

Distribution and habitat. Northern Oman, in the foothills and slopes of the Western Hajra mountains, on sandy places and in cultivated fields. *Altitude*: 200–1900 m. Distributed in tropical and warm temperate regions throughout the world. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 126.

8. ***Eragrostis unioloides*** (Retz.) Nees ex Steud., Syn. Pl. Glumac. 1: 264 (1854).
Synonym. Poa unioloides Retz. (1789).

Description. Tufted, short-lived perennial up to 80 cm high; leaf-blades flat or loosely inrolled, subamplexicaul. Panicle 5–20 cm long, narrowly oblong to broadly ovate in outline, open to fairly dense. Spikelets broadly ovate to oblong, 3.5–16 mm long, 10- to 50-flowered, shedding their florets from below upwards, the palea falling with the lemma, the rhachilla tough; glumes unequal, lanceolate to narrowly ovate, subacute, the lower 1.3–1.7 mm long, the upper 1.7–1.9 mm long; lemmas ovate in profile (suborbicular when flattened), (1.5–)1.8–2.2 mm long, membranous with prominent veins, punctulate, mucronulate; palea keels scabrid.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar on Jebal Qamar, with *Dodonaea*. *Altitude*: ± 950 m. Distributed from Pakistan and India eastwards to Southeast Asia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 127.

9. ***Eragrostis mahrana*** Schweinf. in Bull. Herb. Boissier 2, app. 2: 42 (1894) as '*mahranа*' – Type: Yemen, *Schweinfurth* 208 (syntypes, B, K).

Synonym. E. fruticans Jedwabn. (1924) – Type as for *E. mahrana*.

Description. Tough glaucous perennial forming spiny cushions or small bushes up to 30 cm high, the branches clothed in persistent imbricate leaf-sheaths; leaf-blades pungent, often deciduous from the sheath. Panicle 3–7 cm long, ovate in outline, the spikelets on pedicels less than 1 mm long. Spikelets linear to narrowly oblong, 4–14 mm long, 5- to 30-flowered, the longer spikelets often falcately curved, the florets disarticulating in groups from above, some lemmas also falling, their paleas persistent for a short time; glumes equal, lanceolate, 1.3–1.5 mm long, acute; lemmas oblong-elliptic in profile, 1.9–2.6 mm long, membranous, scrabridulous, broadly obtuse; palea equalling or exceeding the lemmas, the keels scabrid.

Flowering and fruiting. April to May; October.

Distribution and habitat. Throughout Oman, in sand and gravel in deserts, and along watercourses in desert wadis. *Altitude*: 20–100 m. Distributed in Somalia and possibly also Ethiopia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 128.

10. ***Eragrostis papposa*** (Roem. & Schult.) Steud., Nomencl. Bot., ed. 2, 1: 564 (1840).
Synonyms. Megastachya papposa Roem. & Schult. (1817); *Eragrostis aulacosperma* var. *perennis* Schweinf. (1894) – Types: Yemen, *Schweinfurth* 1452 (B), 1654 (K) 1946 (B).

Description. Compactly tufted, short-lived perennial up to 60 cm high; basal leaf-sheaths terete, not compressed; leaf-blades glaucous, stiff, flat or inrolled, in the latter state usually ± confined to the base of the plant, older blades disarticulating from the sheath. Panicle 5–22 cm long, ovate in outline, either open with filiform branches and capillary pedicels or more compact with shorter, stouter pedicels. Spikelets linear, pallid to leaden-grey, 3.2–8.5 mm long, 5- to 18(–22)-flowered, shedding their lemmas from below upwards, the paleas persistent on the tough rhachilla; glumes unequal, linear-lanceolate, the lower 0.3–1(–1.4) mm long, the upper 1–1.4(–1.8) mm long; lemmas narrowly ovate in profile, membranous, 1.2–1.9 mm long, obtuse; palea keels scrabridulous.

Flowering and fruiting. May to August.

Distribution and habitat. Northern Oman, on the Western Hajra mountains, in sandy wadi beds, in pockets of sand on rocky slopes, amongst boulders. *Altitude*: 450–2400 m. Distributed in Southern Europe and North Africa southwards to northern Tanzania and eastwards to Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 129; Collenette, l.c., p. 381.

Notes. A deceptive species presenting several facies. Typically, it has a basal cushion of leaves with tightly rolled blades and a loose open panicle, but the blades may be flat, the leaves more evenly distributed along the culm and the panicle may be more compact. The

two sources of variation are independent of one another, particularly in our area; in Africa, for example, there is a temptation to subdivide the species, but this will not work in Arabia. The perennial habit of the plant is not always immediately obvious, making it hard to key out correctly at times.

11. ***Eragrostis cilianensis*** (All.) Vignolo ex Janch. in Mitt. Naturwiss. Vereins Univ. Wien 5(9): 110 (1907).
Synonym. Poa cilianensis All. (1785).

Description. Annual up to 75 cm high; leaf-blades flat or inrolled, sometimes with crateriform glands along the margins. Panicle 5–15(–20) cm long, lanceolate to narrowly elliptic in outline, usually ± contracted with short pedicels, occasionally very contracted to a dense ovoid or cylindrical head, the branches and pedicels often bearing crateriform glands. Spikelets oblong-ovate (linear when many-flowered), green to leaden-grey, 4.5–15(–20) mm long, 8- to 30(–45–)-flowered, shedding their lemmas from below upwards, the paleas persistent on the tough rhachilla, often the rhachilla fragile in the upper part, rarely breaking away entire soon after the lemmas have begun to fall, exceptionally fragile throughout with the florets falling from the top downwards; glumes subequal, lanceolate, 1.5–2.7 mm long, acute, often with crateriform glands along the vein; lemmas elliptic-ovate in profile, chartaceous, 2–2.8 mm long, scabridulous, subacute to obtuse; palea keels scabrid. Caryopsis usually subrotund in outline, 0.4–0.6 mm in diameter, rarely broadly oblong.

Flowering and fruiting. February to April; September, October.

Distribution and habitat. Northern and Southern Oman, on gravelly, sandy and silty soils on rocky hillside and wadis, in cultivations. *Altitude*: 50–250 m. Tropical and warm temperate Old World. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 130; Collenette, l.c., p. 378.

Notes. A widespread and extremely variable weed in which the mode of disarticulation of the spikelet is clearly a very unstable character. In most cases the spikelet breaks up conventionally from below leaving the persistent paleas, but once the lemmas have begun to fall the rhachilla becomes extremely fragile and can fracture at any point above the pedicel. There are no known instances of lemmas and palea falling together to leave a bare tough rhachilla but two specimens are known, one from Saudi Arabia and the other from Yemen, in which the florets fall from above downwards with the rhachilla internodes, leaving behind the ± persistent glumes (these normally drop before the first lemmas).

The distinction between *E. cilianensis* and *E. minor* is not always clear although in most cases the two can be separated just on overall appearance of the plant, but this is rather hard to explain. Generally, *E. cilianensis* has a broader spikelet with longer lemmas and an almost spherical caryopsis, but troublesome intermediates can sometimes be found.

12. ***Eragrostis minor*** Host, Icon. Descr. Gram. Austriac. 4: 15 (1809).
Synonym. E. pooides P. Beauv. (1812), as '*poaeoides*,' based on *Poa eragrostis* L.

Description. Annual up to 60 cm high; leaf-blades flat or inrolled, with crateriform glands along the margins. Panicle 3–20 cm long, elliptic or ovate in outline, rather open but with short pedicels, the branches and pedicels bearing crateriform glands. Spikelets linear to narrowly oblong, green or olive, leaden-grey or reddish, 4.8–9 mm long, 8- to 16-flowered, shedding their lemmas from below upwards, the paleas persistent on the tough rhachilla; glumes subequal, lanceolate, 1.3–1.8 mm long, acute, sometimes with crateriform glands along the vein; lemmas ovate in profile, chartaceous, 1.4– 1.8 mm long, scabridulous, obtuse; palea keels scabrid. Caryopsis usually broadly oblong in outline, sometimes subrotund, (0.5–)0.6–0.8 mm long.

Flowering and fruiting. April; September.

Distribution and habitat. Northern and Southern Oman, on sandy and stony soils, along wadi beds, and in areas of cultivation. *Altitude*: 50–1300 m. Subtropical and warm temperate Old World. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 131; Collenette, l.c., p. 380.

Notes. Differs from *E. ciliamensis* mainly by the narrower spikelets, shorter lemmas and oblong caryopsis; and from *E. barrelieri* mainly by the presence of crateriform glands along the leaf margins.

A curious form from Dhofar, almost always associated with ant nests, has a densely contracted, cylindrical panicle, and is often the only species that the ants allow to grow on the soil above their nests (in other instances *Arundinella pumila* was treated in the same way but showed no morphological modification).

13. ***Eragrostis barrelieri*** Daveau in J. Bot. (Morat) 8: 289 (1894).

Description. Annual up to 60 cm high; leaf-blades flat or inrolled, always without crateriform glands on the margins. Panicle 3–15 cm long, lanceolate to elliptic in outline, the spikelets evenly spaced or gathered into fascicles, very rarely a dense ovoid head, the primary branches solitary or paired, the branches and pedicels often bearing crateriform glands. Spikelets linear, pallid, greyish or reddish, 6–15 mm long, 8- to 25-flowered, shedding their lemmas from below upwards, the paleas persistent on the tough rhachilla; glumes unequal, lanceolate, acute, without crateriform glands on the vein, the lower 1–1.5 mm long, the upper 1.3–2.1 mm long; lemmas oblong-lanceolate in profile, chartaceous, 1.7–2.3 mm long, scabridulous above, obtuse; palea keels scabrid. Caryopsis oblong-ellipsoid, 0.6–1 mm long.

Flowering and fruiting. February to April; September.

Distribution and habitat. Northern and Southern Oman, on sandy, gravelly and stony soils, along *falajs*, and in areas of cultivation. *Altitude*: 50–800 m. Mediterranean region, tropical

Africa and Southwest Asia. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 132; Collenette, l.c., p. 378.

Notes. This is the third member of a difficult group that includes *E. ciliamensis* and *E. minor*. In lemma length, it is intermediate, but it lacks the crateriform glands along the leaf margins of *E. minor*. Its caryopsis is more elliptical than oblong, approaching fusiform in extreme examples, and therefore quite different from the subrotund caryopsis of *E. ciliamensis*. *E. barrelieri* has a tendency to produce reduced panicles from the lower leaf-sheaths, but whilst this can impart a characteristic appearance to the plant it is not consistent and therefore not diagnostic.

32. **Coelachyrum** Hochst. & Nees

Six species; Africa, Arabian Peninsula, Indian Subcontinent.

1. Spikelets subsessile or shortly pedicelled and rather distant along the raceme-like branches of an open panicle ..... 1. **C. piercei**
   Spikelets subsessile and closely overlapping in subdigitate or scattered racemes 2
2. Racemes scattered along an axis which is several times as long as the longest raceme; lemma with short clavate hairs on the back below ..... 4. **C. yemenicum**
   Racemes subdigitate or on an axis which is only a little longer than the longest raceme; lemmas sparsely to densely clothed with simple, not clavate, hairs on the lateral veins and flanks 3
3. Annual without stolons; hairs on lemma rather short and inconspicuous ..... 2. **C. brevifolium**
   Perennial with woody stolons; hairs on lemma long and shaggy ..... 3. **C. poiflorum**

1. ***Coelachyrum piercei*** (Benth.) Bor in Kew Bull. 7: 226 (1952).

Synonyms. Eragrostis piercei Benth. (1881); *Coelachyrum stoloniferum* C.E. Hubb. (1941).

Description. Tufted perennial, sometimes stoloniferous, up to 45 cm high. Inflorescence an open panicle, 5.5–11 cm long, the branches often racemose, the spikelets borne on pedicels 1–4 mm long. Spikelets 7- to 16-flowered, ovate, 4.5–7.5 mm long; glumes unequal, ovate-elliptic, the lower (1.7–)2.2–3 mm long, the upper (2.1–)3–3.5 mm long, mucronate; lemmas broadly elliptic, 2.4–3 mm long, smooth and glabrous or sometimes shortly hairy on the margins, broadly rounded to truncate, mucronate.

Flowering and fruiting. February.

Distribution and habitat. Northern and Central Oman, in sandy deserts. *Altitude*: 50–150 m. Somalia and Pakistan (Baluchistan). Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 133; Collenette, l.c., p. 364.

2. ***Coelachyrum brevifolium*** Hochst. & Nees in Linnaea 16: 221 (1842) –Type: Saudi Arabia, *Schimper* 799 (syn. K).
Synonym. Eragrostis coelachyrum Benth. (1881), nom. superfl., based on *C. brevifolium*.

Description. Annual, without stolons, up to 35 cm high. Inflorescence 2–4 cm long, comprising 3–6 subdigitate racemes on an axis scarcely longer than the longest raceme, the spikelets subsessile. Spikelets 5- to 8-flowered, broadly ovate, 3–3.4 mm long; glumes unequal, broadly ovate to broadly elliptic, mucronate, the lower 1.2–1.7 mm long, the upper 1.6–2.5 mm long; lemmas broadly elliptic to subrotund, 1.8–2 mm long, shortly and inconspicuously hairy, broadly rounded to truncate, mucronate.

Flowering and fruiting. February/March.

Distribution and habitat. Northern Oman, on sandy ground and in cultivated fields. *Altitude*: 5–50 m. North & Northeast Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 134; Collenette, l.c., p. 364.

3. ***Coelachyrum poiflorum*** Chiov. in Annuario Reale Ist. Bot. Roma 7: 75, t. 3/4 (1897).
Synonym. C. induratum Pilg. ex Schwartz (1939 p.330) – Syntypes: Yemen, *Rathjens* 40, 721 (whereabouts uncertain).

Description. Tufted perennial with woody stolons, up to 35 cm high. Inflorescence 2–4 cm long, comprising 3–5 racemes scattered along an axis at most a little longer than the longest raceme, the spikelets subsessile. Spikelets 6- to 16-flowered, ovate, 2.6–5.6 mm long, often blackish; glumes unequal, the lower ovate, 1.5–2 mm long, the upper broadly ovate, 2–2.3 mm long, mucronate or shortly (± 0.3 mm) awned; lemmas broadly ovate-elliptic, 2.1–2.3 mm long, with long shaggy hairs, obtuse to truncate, mucronate.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on rocky hillsides. *Altitude*: ± 800 m. Northeast Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 135; Collenette, l.c., p. 364.

4. ***Coelachyrum yemenicum*** (Schweinf.) S.M.Phillips, Kew Bull. 37: 159 (1982).
Synonym. Eragrostis yemenica Schweinf. (1894).

Description. Tufted perennial, sometimes stoloniferous, up to 45 cm high. Inflorescence an open panicle, 5.5–11 cm long, the branches often racemose, the spikelets borne on pedicels 1–4 mm long. Spikelets 7- to 16-flowered, ovate, 4.5–7.5 mm long; glumes unequal, ovate-elliptic, the lower (1.7–)2.2–3 mm long, the upper (2.1–)3–3.5 mm long, mucronate; lemmas broadly elliptic, 2.4–3 mm long, smooth and glabrous or sometimes shortly hairy on the margins, broadly rounded to truncate, mucronate.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on rocky hillsides. *Altitude*: ± 350 m. Also Somalia and Pakistan (Baluchistan). Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 136; Collenette, l.c., p. 365.

33. **Eleusine** Gaertn.

Ten species; Tropical and subtropical regions of the Old World; Brazil to S South America.

1. Racemes 9–15 mm wide; spikelets ovate, non-shattering, very closely overlapping; caryopsis plump, almost globose, usually brown, often exposed between the gaping lemmas and palea ..... 3. **E. coracana**
   Racemes 3–7 mm wide; spikelets elliptic, disarticulating between the florets; caryopsis oblong to broadly oblong, blackish, never exposed when ripe 2
2. Lower glume 1-veined, 1.1–2.3 mm long; upper glume 1.8–2.9 mm long; lemmas 2.4–3.6(–4) mm long; caryopsis obliquely striate with very fine close perpendicular lines running between the striae ..... 1. **E. indica**
   Lower glume often 2- to 3-veined, 2–3.2(–3.9) mm long; upper glume 3–4.7 mm long; lemmas 3.7–4.9 mm long; caryopsis obliquely ridged, uniformly granular ... . 2. **E. africana**

1. ***Eleusine indica*** (L.) Gaertn., Fruct. Sem. Pl. 1: 8 (1788).
Synonym. Cynosurus indicus L. (1753).

Description. Slender annual up to 85 cm high; ligule sparsely and minutely ciliolate. Inflorescence comprising 1–10(–17) slender digitate racemes (a few often set below the rest), 3.5–15.5 cm long, 3–5.5 mm wide. Spikelets 3- to 9-flowered, elliptic, 4.6–7.8 mm long, pale green or with a brownish tinge; glumes unequal, acute, the lower 1-veined, 1.1–2.3 mm long, the upper 1.8–2.9 mm long; lemmas lanceolate in profile, 2.4–3.6(–4) mm long, acute to subacute, with 1 or 2 additional veins on either side of the keel. Caryopsis obliquely striate with very fine perpendicular lines running between the striae. Diploid, 2n = 18.

Flowering and fruiting. September.

Distribution and habitat. Southren Oman, Dhofar, along roadside and in disturbed places. *Altitude*: ± 350 m. A pantropical weed. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration. 137; Collenette, l.c., p. 374.

2. ***Eleusine africana*** Kenn.-O'Byrne in Kew Bull. 12: 65 (1957).
Synonym. E. indica subsp. *africana* (Kenn.O'Byrne) S.M.Phillips (1972).

Description. Moderately robust annual up to 90 cm high; ligule with a pronounced ciliate fringe. Inflorescence comprising 3–15 stout digitate racemes (a few often set below the rest), 4–17 cm long, 4–7 mm wide. Spikelets 3- to 9-flowered, elliptic, 4–8 mm long, pale

green or with a brownish tinge; glumes unequal, acute, the lower 2- to 3-veined, 2–3.2(–3.9) mm long, the upper 3–4.7 mm long; lemmas lanceolate in profile, 3.7–4.9 mm long, acute to subacute, with 1 or 2 additional veins on either side of the keel. Caryopsis obliquely ridged, uniformly granular. Tetraploid, 2n = 36.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar as a weed of irrigation channels. *Altitude*: ± 850 m. Uplands of eastern and southern Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 138; Collenette, l.c., p. 374.

3. ***Eleusine coracana*** (L.) Gaertn., Fruct. Sem. Pl. 1: 8, t. 1/11 (1788).
Synonym. Cynosurus coracanus (1759).

Description. Robust annual up to 170 cm high. Inflorescence comprising 4–20 linear-oblong subdigitate racemes 4–14 cm long and 9–15 mm wide. Spikelets 6- to 9-flowered, ovate, 5–9 mm long, non-shattering at maturity; glumes unequal, acute, the lower 1.5–3 mm long, the upper 1.8–5 mm long; lemmas narrowly ovate in profile, 2.2–4.7 mm long, subacute, with additional veins on either side of the keel. Caryopsis subglobose, finely striate-punctate, usually brown but varying from black to reddish brown or whitish, exposed between the gaping lemma and palea when ripe.

Flowering and fruiting. January.

Distribution and habitat. Cultivated cereal (Finger Millet), occasionally escaping into the wild but not persisting. *Altitude*: ± 50 m. Cultivated in the Old World tropics and sub-tropics. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 139.

34. **Acrachne** Wight & Arn. ex Chiov.
Three species; tropical and subtropical regions of the Old World to N Australia.

Acrachne racemosa (B.Heyne ex Roth) Ohwi in Bull. Tokyo Sci. Mus. 18: 1 (1947).
Synonyms. Eleusine racemosa B.Heyne ex Roth (1817); *E. verticillata* Roxb. (1820).

Description. Annual, with culms up to 75 cm high. Ligule membranous with a ciliate fringe. Racemes digitate, often with additional whorls below, 1.5–10 cm long. Spikelets 6- to 25-flowered, 5.5–13 mm long, shedding their lemmas but retaining the persistent rhachilla and paleas; glumes unequal, the lower 1.2–3 mm long, acute and mucronate, the upper 1.5–3 mm long, acuminate and awned, the awn one-third to two-thirds the length of the body; lemmas strongly keeled, narrowly ovate in profile, 2–2.8 mm long, the awn 0.3–0.9 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in the foothills of the escarpment mountains, in wadis. *Altitude*: 100–350 m. Old World tropics. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 140.

35. **Dactyloctenium** Willd.

Thirteen species; Africa, tropical and subtropical Asia to Australia.

1. Annual, sometimes stoloniferous 2
   Stoloniferous perennial 3
2. Inflorescence open, the racemes 1.2–6.5(–7.5) cm long, linear to narrowly oblong, ascending or radiating; lemmas acute, cuspidate or mucronate; caryopsis transversely rugose ..... 1. **D. aegyptium**
   Inflorescence compact, the racemes 0.8–1.8(–2.6) cm long, oblong to broadly oblong, clustered in a dense head; lemmas conspicuously acuminate-mucronate; caryopsis granular or granular-striate ..... 2. **D. aristatum**
3. Leaf-blades rigid but neither conspicuously distichous nor pungent .. 3. **D. scindicum**
   Leaf-blades conspicuously distichous, rigid and pungent ..... 4. **D. robecchii**

1. ***Dactyloctenium aegyptium*** (L.) Willd., Enum. Pl.: 1029 (1809).

Synonyms. Cynosurus aegyptius L. (1753); *Eleusine aegyptia* (L.) Desf. (1798).

Description. Annual, often stoloniferous and mat-forming, up to 70(–100) cm high; leaf-blades papillose-hispid, especially on the margins. Inflorescence comprising of (1–)3–9 linear to narrowly oblong racemes 1.2–6.5(–7.5) cm long, these ascending or radiating. Spikelets broadly ovate, 3.5–4.5 mm long; glumes subequal, 1.5–2.2 mm long, the upper with an awn from half as long to as long as the body; lemmas narrowly ovate in profile, 2.6–4 mm long, acute and with a stout cusp or mucro up to 1 mm long; anthers 0.25–0.8 mm long. Caryopsis transversely rugose.

Flowering and fruiting. January to April; September, October.

Distribution and habitat. Throughout Oman including Musandam, on sandy ground in wadis, and as a weed of cultivation. *Altitude*: 2–500 m. Tropical and warm temperate regions of the Old World. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 141; Collenette, l.c., p. 367.

2. ***Dactyloctenium aristatum*** Link, Hort. Berol. 1: 59 (1827).

Synonyms. Cynosurus aegyptiacus Forssk. (1775), non L. (1753) – Type: Saudi Arabia, *Forsskål* 1179 (C; poor specimen, unidentifiable with certainty); *Eleusine aegyptia* auct. non (L.) Desf.

Description. Sprawling, geniculately ascending annual, often rooting from the lower nodes.

up to 40 cm high; leaf-blades conspicuously papillose-hispid. Inflorescence comprising of (2–)4–7(–11) oblong or broadly oblong racemes 0.8–1.8(–2.6) cm long, these clustered in a dense, often ovoid head. Spikelets broadly ovate, 4.1–5.2 mm long; glumes subequal, 1.7–2.3 mm long, the upper with an awn as long as or longer than the body; lemmas lanceolate to narrowly ovate in profile, (3–)3.3–4.3 mm long, acuminate and often with a stout mucro up to 1 mm long; anthers 0.3–0.5 mm long. Caryopsis granular or granular-striate.

Flowering and fruiting. February to April.

Distribution and habitat. Northern and Southern Oman, on sandy and stony ground and disturbed places. *Altitude*: 0–100 m. East Africa to Northwest India. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 142; Collenette, l.c., p. 367.

3. ***Dactyloctenium scindicum*** Boiss., Diagn. Pl. Orient. 3(4): 131 (1859).
Synonyms. D. glaucophyllum Courbai (1862); *Eleusine glaucophylla* (Courbai) Munro ex Benth. (1881); *E. aristata* Ehrenb. ex Boiss. (1884), in syn.

Description. Stoloniferous mat-forming perennial up to 45 cm high; leaf-blades tough and rather glaucous, flat or folded, loosely papillose-hispid. Inflorescence comprising of 3–4(–5) slightly falcate, oblong racemes 0.8–2 cm long, these forming a compact head. Spikelets broadly lanceolate to ovate, 4–8 mm long; glumes subequal, 1.5–2.5 mm long, the upper with an awn half as long to as long as the body; lemmas lanceolate in profile, 3–3.8 mm long, acute and with a mucro up to 0.8 mm long; anthers 1.1–2 mm long. Caryopsis transversely rugose.

Flowering and fruiting. April; October, December.

Distribution and habitat. Northern and Southern Oman, on stony and sandy soils and in areas of cultivation. *Altitude*: 50–550 m. Northeast Africa to Northwest India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 143; Collenette, l.c., p. 368.

4. ***Dactyloctenium robecchii*** Chiov., Fl. Somala 1: 337 (1929).

Description. Tough, mat-forming or sub-shrubby perennial with scaly stolons, up to 30 cm high; leaf-blades short, distichous, rigid and pungent. Inflorescence comprising of (2–)3–4(–5) oblong racemes 0.8–2 cm long, these forming a compact head. Spikelets broadly ovate, 2.8–4.2 mm long; glumes subequal, 1–2.5 mm long, the upper with an awn half as long to as long as the body; lemmas elliptic in profile, 2.4–4 mm long, acute, apiculate or mucronate; anthers 1.2–1.4 mm long. Caryopsis granular.

Flowering and fruiting. July, September.

Distribution and habitat. Southern Oman, on north facing foothills of Jebel Qara, on stony ground along wadi banks, and on low hills. *Altitude*: 50–500 m. Also Somalia. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration. 144.

36. **Desmostachya** (Hook.f.) Stapf
A single species; Sahara to Tanzania and Indo-China.

Desmostachya bipinnata (L.) Stapf in Dyer, Fl. Cap. 7: 632 (1900).
Synonyms. Cynosurus durus Forssk. (1775), non L. (1753); *Eragrostis bipinnata* (L.) K. Schum. (1895); *E. cynosuroides* (Retz.) P. Beauv. (1812).

Description. Harsh, tussock-forming rhizomatous perennial up to 1.5 m high; lower leaf-sheaths leathery, often densely flabellate; ligule a line of hairs. Inflorescence up to 60 cm long, the racemes 1–4 cm long, erect or curving outwards from the main axis. Spikelets narrowly ovate to linear-oblong, 3–10 mm long; glumes unequal, the lower 0.7–1.5 mm long, the upper 1.1–2 mm long; lemmas keeled, glabrous, straw-coloured or suffused with purple, 1.8–2.7 mm long.

Flowering and fruiting. January; July.

Distribution and habitat. Northern and Southern Oman, in dry places, by roadsides and in ditches, especially where the water table, fresh or saline, is not too far from the surface. *Altitude*: 50–350 m. Distribution as for the genus. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen, Socotra, Oman, UAE.

Distribution map & Illustration. 145; Collenette, l.c., p. 368.

37. **Sporobolus** R. Br.
About 185 species; cosmopolitan except Antartica.

1. Panicle branches, or at least the lowermost, in whorls; panicle open or sometimes loosely contracted 2
   Panicle branches not whorled, not even the lowermost 5
2. Annual 3
   Perennial 4
3. Caryopsis spherical or subglobose, 0.3 mm in diameter ..... 1. **S. minimus**
   Caryopsis obovoid, 0.7–0.8 mm long ..... 2. **S. coromandelianus**
4. Basal leaf-sheaths chartaceous, keeled, ± flabellate; panicle with axis and branches glandless or with sparse glandular patches ..... 3. **S. ioclados**
   Basal leaf-sheaths coriaceous, rounded, not at all flabellate; panicle with dark sticky glandular patches on the axis and lower branches ..... 4. **S. gloeoclados**
5. Panicle dense, spike-like, or the primary branches bearing spikelets or branchlets from the extreme base 6
   Panicle loose and diffuse, or if with the spikelets clustered then the primary branches bare of spikelets and branchlets for at least a quarter their length 10

6. Leaf-blades pungent, often tightly inrolled; panicle spike-like (if plant forming dense cushions up to 10 cm deep and with short broad flat leaf-blades 7
Leaf-blades not pungent 8
7. Panicle smoothly cylindrical; leaf-blades not conspicuously distichous .. 5. **S. spicatus**
Panicle untidily cylindrical; leaf-blades conspicuously distichous .... 6. **S. virginicus**
8. Panicle branches smooth; lower glume as long as the spikelet or almost so, 1-veined; upper glume similar ..... 7. **S. consimilis**
Panicle branches spiculate; lower glume much shorter than the spikelet, up to one-third as long, hyaline, veinless; upper glume up to three-quarters as long as the spikelet 9
9. Upper glume obtuse; panicle narrowly pyramidal ..... 8. **S. pyramidalis**
Upper glume acute; panicle narrowly lanceolate ..... 9. **S. pellucidus**
10. Annual ..... 10. **S. tenuissimus**
Perennial 11
11. Spikelets evenly distributed, not clustered, the panicle diffuse ..... 11. **S. airiformis**
Spikelets clustered about the branches or branchlets 12
12. Panicle with the spikelets appressed and ± secund along much of the length of the branches or branchlets 13
Panicle with the spikelets gathered into clumps at the tips of the branches or branchlets..... 14
13. Spikelets 2–3 mm long; anthers 0.7–1.2 mm long; caryopsis 1–1.2 mm long ..... 12. **S. angustifolius**
Spikelets 1.2–1.6 mm long; anthers 0.3–0.4 mm long; caryopsis 0.6–0.8 mm long .... 13. **S. diander**
14. Panicle loose and open, the branches and branchlets slender, flexuous ..... 14. **S. nervosus**
Panicle contracted, the branches short and stiff 15
15. Plant densely tufted, forming cushions up to 10 cm deep; leaf-blades short, broad and densely imbricate ..... 15. **S. tourneuxii**
Plant loosely tufted with extensively creeping stolons; leaf-blades slender, not at all imbricate ..... 16. **S. ruspolianus**

1. ***Sporobolus minimus*** Cope in Kew Bull. 47: 657 (1992) Type: Oman, Dhofar, Wadi Arzat, near Salalah, Oct. 1984, *McLeish* 145 (holo., E).

Description. Dwarf annual up to 14 cm high; leaf-blades flat, rigid, 1.5–4 mm wide. Panicle oblong in outline, 1.5–4 cm long; primary branches in whorls, the lower most not barren. Spikelets ± 0.7 mm long; lower glume elliptic, as long as the spikelet; upper glume broadly elliptic, fractionally shorter than the lower; lemma similar to the upper glume; anthers 3, ± 0.1 mm long. Caryopsis subglobose, ± 0.3 mm in diameter.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, in dry, coastal wadis. *Altitude*: ± 10 m. Also Somalia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 146.

Notes. This remarkable species is probably the smallest of all *Sporobolus*, smaller in all its parts (except leaf width) than any other species from the Old World. In the Oman Plant Red Data Book: 2014, p. 230, it is assessed as Vulnerable (VU D2), for its localised population which is under threat from urban development and livestock farming.

2. ***Sporobolus coromandelianus*** (Retz.) Kunth, Révis. Gramin. 1: 68 (1829).
Synonym. Agrostis coromandeliana Retz. (1786).

Description. Annual up to 20 cm high; leaf-blades flat, 2–4 mm wide. Panicle ovate in outline, 2–8 cm long; primary branches in whorls, the lowermost never barren. Spikelets 1–1.4 mm long; lower glume oblong, 0.1–0.5 mm long; upper glume oblong-elliptic, as long as the spikelet; lemma similar to the upper glume, but a little shorter; anthers 3, 0.2–0.3 mm long. Caryopsis obovoid, 0.7–0.8 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in sandy wadi beds and coastal sandy plains. *Altitude*: 10–120 m. Old World tropics, but mainly India and southern Africa. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 147.

3. ***Sporobolus ioclados*** (Nees ex Trin.) Nees, Fl. Afr. Austral. Ill. 1: 161 (1841).
Synonyms. Vilfa ioclados Nees ex Trin. (1840); *Sporobolus marginatus* Hochst. ex A. Rich. (1850); *S. arabicus* Boiss. (1853) – Type: Oman, *Aucher-Eloy* 5425 (whereabouts uncertain); *S. jemenicus* Pilg. ex Schwartz (1939) – Type: Yemen, *Rathjens* 440, 732 (whereabouts uncertain).

Description. Tussocky perennial, often with creeping stolons, up to 80 cm high; leaf-blades flat or inrolled, harsh or soft, often pungent; basal leaf-sheaths persistent, chartaceous, often keeled and flabellate. Panicle narrowly ovate to triangular in outline, 4–15 cm long; primary branches in whorls (at least the lowermost), bare of spikelets in the lower quarter to third. Spikelets 1.5–3(3.3) mm long; lower glume narrowly ovate to narrowly oblong, 0.5–1 mm long, obtuse; upper glume narrowly ovate to lanceolate, (half to) two-thirds as long to as long as the spikelet; lemma lanceolate-elliptic, as long or almost as long as the spikelet; anthers 3, 0.9–1.4 mm long. Caryopsis ellipsoid, 0.8–1.2 mm long.

Flowering and fruiting. February to April; September, October.

Distribution and habitat. Throughout Oman, including Masirah and Halaniyah Islands, in the foothills of the Hajar mountains, on rocky slopes, wadi beds, in sandy desert and semi-desert, coastal areas and mangrove swamps; one of the most common grass species in Oman. *Altitude*: 5–150 m. Tropical Africa to India and Sri Lanka. Elsewhere in the Ara-

bian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 148; Collenette, l.c., p. 414.

Notes. Until recently it was thought that 3 species could be recognized within *S. ioclados*, although it was always understood that they were never going to be easy to distinguish. *S. kentrophyllus* was originally separated on account of the apparent correlation between its preference for mangrove swamps and its relatively short upper glume. However, too much reliance on glume length as diagnostic has led to the inclusion of many non-mangrove specimens in the species and has so diluted its distinction from *S. ioclados* that it is now untenable.

No easily measurable characters are available for distinguishing between *S. ioclados* and *S. arabicus*; reliance has always been placed on leaf form: rolled, stiff and pungent leaf-blades in *S. arabicus* and flat, soft, non-pungent blades in *S. ioclados*. In fact, leaf form seems to be a product of environment and plants from the more arid areas are more likely to have a rolled pungent blade. Indeed, by far the majority of specimens from Africa to India have flat, but stiff and pungent blades, exactly midway between the ideals for either species. It seems now that the distinction between *S. ioclados* and *S. arabicus* is at the ecotypic rather than the specific level.

4. ***Sporobolus gloeoclados*** Cope in Kew Bull. 47: 656 (1992) – Type: Oman, Dhofar, Jebal Qara, *Vesey-FitzGerald* 1246/22 (holo. K; iso. BM).

Description. Greyish green loosely tufted perennial, the culms often procumbent and creeping, geniculately ascending, up to 25 cm high, clothed at the base in whitish cataphylls comprising a short broad coriaceous sheath and a rudimentaty blade; leaf-blades flat, stiff and pungent, loosely villous with bulbous-based hairs. Panicle triangular in outline, 3–5.5 cm long, the axis and lower branches covered in dark sticky glandular patches; primary branches in whorls (at least the lowermost), bare of spikelets in the lower third to half. Spikelets 1.5–1.9 mm long; lower glume narrowly ovate to narrowly oblong, 0.3–0.6 mm long, acute to obtuse; upper glume narrowly ovate, half to two-thirds the length of the spikelet; lemma lanceolate-elliptic, as long as the spikelet; anthers 3, 0.9–1.2 mm long. Caryopsis not known.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in the foothills of Jebal Qara, on rocky slopes. *Altitude*: 80–350 m. Also Pakistan and China (unconfirmed). Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 149.

5. ***Sporobolus spicatus*** (Vahl) Kunth, Révis. Gramin. 1: 67 (1829).
Synonyms. Agrostis spicata Vahl (1790); *A. virginica* Forssk. (1775), non L. (1753).

Description. Tufted, sometimes mat-forming, perennial; culms wiry, up to 70 cm high, often with fascicles of shoots at the nodes, arching over and rooting to form long looping stolons; leaf-blades stiff and pungent, usually inrolled but sometimes flat, often painfully sharp. Panicle spike-like, smoothly and compactly cylindrical, 15–20 cm long, the branches closely appressed to the main axis. Spikelets (1.7–)2.2–2.8 mm long; lower glume broadly ovate to lanceolate, 0.5–0.9 mm longA.; upper glume narrowly ovate to narrowly lanceolate, two-thirds as long to as long as the spikelet; lemma oblong-elliptic, as long as the spikelet; anthers 3, 1–1.5 mm long. Caryopsis ellipsoid, 0.7–1.1 mm long.

Flowering and fruiting. January to April; September, October.

Distribution and habitat. Throughout Oman, in sandy deserts and coastal areas, on sandy soils and areas of brackish and saline. *Altitude*: 10–500 m. Africa to India. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 150; Collenette, l.c., p. 416.

6. ***Sporobolus virginicus*** (L.) Kunth, Révis. Gramin. 1: 67 (1829).
Synonym. Agrostis virginica L. (1753).

Description. Rhizomatous perennial up to 30 cm high; leaf-blades conspicuously distichous (especially on sterile shoots), inrolled, stiff and pungent. Panicle spike-like, untidily cylindrical, 2–10 cm long, the branches closely appressed to the main axis. Spikelets 1.7–2.6 mm long; lower glume lanceolate, acute, 1.2–2 mm long, but variable even within the panicle; upper glume narrowly ovate-elliptic, acute, as long as the spikelet; lemma similar to the upper glume and equal to it; anthers 3, 1–1.3 mm long. Caryopsis subglobose, ± 0.7 mm in diameter.

Flowering and fruiting. January to April; September, October.

Distribution and habitat. Throughout Oman, including Masirah and Halaniyah Islands, in dry desert wadis, sand dunes, and mangrove swamps and around brackish pools. *Altitude*: 0–150 m. Distributed in throughout the Tropics and subtropics of the world. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 151.

Notes. Doubtfully distinct from the Mediterranean *S. pungens* (Schreb.) Kunth (*S. arenarius* (Gouan) Duval-Jouve) which has an ovate rather than cylindrical panicle embraced below by the uppermost leaf-sheath.

7. ***Sporobolus consimilis*** Fresen. in Mus. Senckenberg. 2: 140 (1837).

Description. Robust perennial tussock-grass with short rhizomes, sometimes forming looping stolons, 1.3–3 m high, the culms 3.5–8 mm across at the base; leaf-blades flat, harshly scabrid along the margins. Panicle linear-lanceolate in outline, 25–35 cm long, the primary branches bearing spikelets or branchlets from the base, smooth. Spikelets 1.7–2.3 mm long;

lower glume lanceolate, 1.3–2.3 mm long, acute; upper glume narrowly ovate, almost as long as the spikelet; lemma similar to the upper glume, as long as the spikelet; anthers 3, 1–1.3 mm long. Caryopsis narrowly oblong in outline, tetragonal in section, 0.7–1 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, by permanent pools on sandy or saline soils. *Altitude*: ± 450 m. Tropical Africa southwards to South Africa and Namibia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 152; Collenette, l.c., p. 413.

Notes. Often confused with *S. robustus* Kunth, a species from West African seashores, somewhat intermediate between *S. consimilis* and *S. virginicus*.

8. ***Sporobolus pyramidalis*** P. Beauv., Fl. Oware 2: 36, t. 80 (1816).
Synonyms. Agrostis indica Forssk. (1775), non L. (1753) – Type: Yemen, *Forsskål* 79 (holo., C); *Sporobolus capensis* auct. non (P.Beauv.) Kunth.

Description. Tufted perennial up to 160 cm high, the culms up to 5 mm across at the base; basal leaf-sheaths neither fibrous nor broad and chartaceous. Panicle narrowly triangular in outline, 20–45 cm long, the primary branches spreading horizontally at anthesis, subsecund, densely spiculate from the base. Spikelets 1.6–2 mm long; lower glume broadly oblong, 0.2–0.5 mm long, hyaline and veinless, obtuse; upper glume similar to the lower, a quarter to a third the length of the spikelet; lemma ovate-elliptic, acute, as long as the spikelet; anthers 3, 0.6–1.1 mm long. Caryopsis obovoid, truncate, 0.8–1 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains, on rocky ground, grassy slopes. *Altitude*: ± 800 m. Tropical Africa to South Africa, Madagascar and Mauritius; probably introduced in South America. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 153; Collenette, l.c., p. 416.

9. ***Sporobolus pellucidus*** Hochst. in Flora 38: 201 (1855).

Description. Densely tufted perennial up to 75 cm high; basal leaf-sheaths disintegrating into a cushion of fibres. Panicle narrowly lanceolate in outline, 6–20 cm long, the primary branches 1–2 cm long, spreading or ascending, subsecund, branched from the base, the branchlets densely spiculate from the base. Spikelets 1.7–2(–2.2) mm long; lower glume oblong and obtuse to ovate and acute, 0.5–0.7 mm long; upper glume narrowly ovate, acute, half to three-quarters the length of the spikelet; lemma ovate-elliptic, acute, as long as the spikelet; anthers 3, 0.8–0.9 mm long. Caryopsis obovoid to ellipsoid, 0.6–0.8 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in shallow wadis and cliffs on sandy and silty soils. *Altitude*: ± 850 m. Tropical Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 154; Collenette, l.c., p. 416.

10. ***Sporobolus tenuissimus*** (Mart. ex Schrank) Kuntze, Revis. Gen. Pl. 3: 396 (1893). *Synonym. Panicum tenuissimum* Mart. ex Schrank (1822).

Description. Weak annual up to 80 cm high. Panicle narrowly oblong in outline, 10–40 cm long, very delicate and diffuse, the branches and pedicels capillary. Spikelets 0.8–1.1 mm long; lower glume oblong, raggedly truncate, 0.1–0.3 mm long; upper glume ovate-oblong, subacute, about half the length of the spikelet; lemma ovate, as long as the spikelet; anthers 3, 0.1–0.2 mm long. Caryopsis obovoid, truncate, 0.4–0.5 mm long.

Flowering and fruiting. January; September.

Distribution and habitat. Northern and Southern Oman, as weed of date gardens. *Altitude*: 50–250 m. Tropical Africa, tropical Asia eastwards to Myanmar and tropical America. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 155.

11. ***Sporobolus airiformis*** Chiov., Miss. Biol. Borana, Racc. Bot. Angiosp.-Gymnosp.: 277 (1939).

Description. Densely tufted perennial up to 35 cm high; basal leaf-sheaths woolly-tomentose with curly hairs on the margins, horny and yellow, eventually disintegrating to form a cushion of coarse fibres, the woolly hairs retained within. Panicle ovate in outline, 5–8 cm long, diffuse, the branches capillary. Spikelets 1.8–2 mm long; lower glume narrowly ovate to oblong-ovate, 0.5–0.8 mm long; upper glume narrowly ovate, one-third to half the length of the spikelet; lemma narrowly ovate, obtuse or subacute, as long as the spikelet; anthers 3, 1–1.2 mm long. Caryopsis obovoid, ± 1 mm long.

Flowering and fruiting. April; September.

Distribution and habitat. Northern and Southern Oman, in the foothills of the Hajar mountains and Dhofar mountains, on rocky slopes. *Altitude*: 500–850 m. Also Ethiopia and Somalia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 156.

12. ***Sporobolus angustifolius*** A.Rich., Tent. Fl. Abyss. 2: 396 (1850).

Description. Densely tufted perennial up to 60 cm high; basal leaf-sheaths becoming fibrous with age. Panicle linear to narrowly ovate in outline, 5–16 cm long, the spikelets ± secund and loosely contracted about the primary branches, these bare of spikelets in the lower quarter to third. Spikelets 2–3 mm long; lower glume oblong to narrowly ovate,

0.8–1.4 mm long; upper glume narrowly ovate, half to three-quarters the length of the spikelet; lemma narrowly ovate, as long as the spikelet; anthers 3, 0.7–1.2 mm long. Caryopsis ellipsoid, truncate, 1–1.2 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in grassland on rocky slopes. *Altitude*: ± 850 m. Tropical Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 157; Collenette, l.c., p. 413.

13. ***Sporobolus diandrus*** (Retz.) P. Beauv., Ess. Agrostogr.: 26, 147, 178 (1812).
Synonym. Agrostis diandra Retz. (1789).

Description. Tufted perennial without rhizomes, up to 75 cm high; leaf-blades inrolled, rarely flat but then up to 4 mm wide; basal leaf-sheaths remaining intact with age. Panicle narrowly triangular to narrowly lanceolate in outline, lax, up to 20 cm long, the primary branches erect or somewhat spreading, bare of spikelets in the lower quarter to third. Spikelets 1.2–1.6 mm long; lower glume ovate-lanceolate, 0.3–0.5 mm long; upper glume lanceolate to ovate-lanceolate, about half the length of the spikelet; lemmas narrowly ovate, acute, as long as the spikelet; anthers 2, rarely 3, 0.3–0.4 mm long. Caryopsis oblong-ellipsoid, truncate at the top, 0.6–0.8 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar on escarpment mountains, open woodland. *Altitude*: ± 500 m. India and Myanmar to Sri Lanka and Australia. Elsewhere in the Arabian Peninsula found on Soqotra.

Distribution map & Illustration. 158.

14. ***Sporobolus nervosus*** Hochst. in Flora 38: 202 (1855).

Description. Densely tufted perennial arising from a short oblique rhizome, up to 45 cm high; basal leaf-sheaths yellowish, indurated, often covered by the fibrous remains of decaying sheaths; leaf-blades 1–3 mm wide. Panicle ovate or narrowly ovate in outline, 7–20 cm long, the spikelets secund and clustered at the tips of the branchlets, these and the primary branches bare of spikelets below. Spikelets (1.5–)1.7–2.1 mm long; lower glume lanceolate, acute, 0.8–1 mm long; upper glume narrowly ovate, acute, two-thirds to four-fifths the length of the spikelet; lemma narrowly ovate, as long as the spikelet; anthers 3, 0.8–1 mm long. Caryopsis ellipsoid, ± 0.6 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in sandy pockets on rocky slopes in open shrubland. *Altitude*: ± 850 m. Tropical Africa and Namibia eastwards to Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 159; Collenette, l.c., p. 415.

Notes. Similar to *S. angustifolius* but with smaller spikelets and relatively longer upper glume, and with the spikelets clustered at the tips of the branchlets rather than secund along the primary branches.

15. ***Sporobolus tourneuxii*** Coss. in Bull. Soc. Bot. France 36: 250 (1889).

Description. Tufted perennial, often forming dense cushions up to 10 cm deep; culms subwoody and much-branched, the fertile rising to 20 cm; basal leaf-sheaths persistent, densely imbricate; leaf-blades flat, 1–2(–3) cm × 2–3 mm, glaucous, pungent. Panicle ovate or narrowly ovate in outline, 1–4 cm long, open or contracted, the primary branches ascending or spreading, bare of spikelets in the lower third to half (not obvious when panicle contracted), the spikelets gathered into clumps at the tips. Spikelets 1.8–2.1 mm long; glumes subequal, half to two-thirds the length of the spikelet, the lower ovate to lanceolate, the upper oblong-ovate to narrowly elliptic; lemma oblong-lanceolate to elliptic, as long as the spikelet; anthers (2–) 3, 1–1.5 mm long. Caryopsis obovoid, 0.5–0.6 mm long.

Flowering and fruiting. October.

Distribution and habitat. Southern Oman, Dhofar, on escarpment mountain, on rocky hillsides. *Altitude*: ± 850 m. North Africa to northwest India. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 160.

16. ***Sporobolus ruspolianus*** Chiov. in Ann. Bot. (Rome) 5: 64 (1906).

Description. Sub-shrubby, loosely tufted, extensively stoloniferous perennial, the slender woody culms arising from a knotty base and usually branched from the lower nodes, up to 40 cm high; lower leaf-sheaths brown, chartaceous, persistent, not at all imbricate, the very base of the culm clothed in whitish cataphylls; leaf-blades flat, narrow, glaucous, not pungent. Panicle ovate or narrowly ovate in outline, 2.5–6.5 cm long, loose or contracted, the primary branches ascending or spreading, bare in the lower third to half, the spikelets gathered into clumps at the tips. Spikelets 1.4–2.3 mm long; glumes narrowly ovate, acute or obtuse, the lower 0.9–1.3 mm long, the upper two-thirds to three-quarters the length of the spikelet; lemma narrowly ovate, as long as the spikelet; anthers 3, 0.9–1.1 mm long. Caryopsis not known.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, on wadi banks and hillslopes. *Altitude*: ± 450 m. Also Somalia and Ethiopia. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration. 161.

38. **Urochondra** C.E. Hubb.
A single species; NE Tropical Africa to India.

Urochondra setulosa (Trin.) C.E. Hubb. in Hook, Icon. Pl. 35: t. 3457 (1947).
Synonyms. Vilfa setulosa Trin. (1840) – Type: Arabia, *Ehrenberg & Hemprich* (whereabouts uncertain); *Agrostis elatior* Ehrenb. & Hempr. ex Trin. (1840), in syn. – Type as for *V. setulosa*; *Heleochloa dura* (Boiss.) Boiss., (1884).

Description. Perennial, shortly rhizomatous plant up to 90 cm high. Ligule a line of hairs; leaf-blades rigid, inrolled and pungent. Panicle 4.5–16 cm long, spike-like, cylindrical, exserted from the uppermost leaf-sheath. Spikelets 1-flowered without rhachilla extension, strongly laterally compressed and keeled, oblong to obovate-oblong, 2–3 mm long; glumes almost as long as the floret, awnless, linear- or lanceolate-oblong, obtuse or acute, ciliate on the keel, the lower 0.5–2.5 mm long, the upper 2.6–3 mm long; lemma as long as the spikelet, membranous, 1-veined, mucronate, ciliate on the keel. Caryopsis ellipsoid, surmounted by a pallid beak formed from the thickened connate style bases, about a third of its length; pericarp free, swelling when wet.

Flowering and fruiting. February; September, October.

Distribution and habitat. Northern and Southern Oman, on sabkhas, near mangrove swamps and saline flats. *Altitude*: 0–50 m. Distributed in the coastal regions of the Indian Ocean and the Red Sea from Northeast Africa to Northwest India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 162; Collenette, l.c., p. 427.

Tribe XII. CYNODONTEAE Dumort.

1. Spikelets containing 2–5 fertile florets ..... 39. **Tetrapogon**
   Spikelets containing 1 fertile floret 2
2. Racemes persistent, the spikelets breaking up at maturity 3
   Racemes deciduous or the spikelets falling entire 7
3. Both glumes exceeding, closed around and concealing the florets ... 43. **Microchloa**
   One or both glumes shorter than the florets 4
4. Spikelets 1-flowered, awnless ..... 44. **Cynodon**
   Spikelets 2- to several-flowered 5
5. Caryopsis and lemma dorsally compressed ..... 42. **Enteropogon**
   Caryopsis trigonous to subterete; lemma laterally compressed 6
6. Upper glume obtuse to 2-lobed at the tip, distinctly awned; lemma awnless or almost so, dark brown to golden in colour ..... 41. **Eustachys**
   Upper glume acute to faintly 2-toothed at the tip, awnless; lemma awned, usually pallid ..... 40. **Chloris**
7. Spikelets 2-flowered ..... 45. **Melanocenchris**
   Spikelets 1-flowered 8
8. Lower glume very small or suppressed; upper glume and lemma about equal, with raised veins bearing hooked bristles ..... 46. **Tragus**

Lower glume well developed 9
9. Glumes bristle-like ..... 49. **Tetrachaete**
Glumes not bristle-like 10
10. Racemes comprising 2–3 spikelets separated by short internodes ..... 47 **Dignathia**
Racemes comprising 1 spikelet or a pair of spikelets side by side .. 48. **Leptothrium**

39. **Tetrapogon** Desf.
Five species; Africa, temperate and tropical Asia.

Lowermost lemma shortly ciliate or subglabrous ..... 1. **T. tenellus**
Lowermost lemma conspicuously long-ciliate ..... 2. **T. villosus**

1. ***Tetrapogon tenellus*** (K.D. Koenig ex Roxb.) Chiov. in Pirotta, Fl. Eritrea: 352 (1908).
Synonyms. Chloris tenella K.D. Koenig ex Roxb. (1820); *C. macrantha* Jaub. & Spach (1851), non Desv. (1831) – Type: Yemen, *Botta* (P).

Description. Annual up to 50 cm high; basal leaf-sheaths keeled but scarcely flabellate. Racemes solitary, occasionally paired, exserted or partially enclosed by the slightly inflated uppermost leaf-sheath, 2.5–7 cm long. Spikelets laterally compressed, cuneate, with 2–5 fertile florets, the rhachilla terminating in a clavate cluster of sterile lemmas. Glumes inconspicuous, 3–5.5(–6.5–) mm long; fertile lemmas rounded on the back or keeled, coriaceous, entire or 2-toothed at the tip; lowermost lemma 3.7–5.5 mm long, shortly ciliate on the veins or subglabrous; awn 4.5–10.5 mm long.

Flowering and fruiting. July; September.

Distribution and habitat. Southern Oman, Dhofar, on sandy and rocky soils, on wadi banks and wadi fans. *Altitude*: 80–850 m. Tropical Africa and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 163; Collenette, l.c., p. 422.

2. ***Tetrapogon villosus*** Desf., Fl. Atlant. 2: 389, t. 255 (1799).

Description. Densely tufted perennial up to 60 cm high; basal leaf-sheaths keeled and conspicuously flabellate. Racemes usually paired (rarely solitary or up to 4) but often interlocked back to back and appearing solitary, exserted or partially enclosed by the slightly inflated uppermost leaf-sheath, 3–8.5 cm long. Spikelets laterally compressed, cuneate, with 2–5 fertile florets, the rhachilla terminating in a clavate cluster of sterile lemmas. Glumes inconspicuous, 2–4 mm long; fertile lemmas rounded on the back or keeled, coriaceous; lowermost lemma 2.5–3.7 mm long, ciliate on the veins and keel with hairs 3–8 mm long; awn 8.5–13 mm long.

Flowering and fruiting. February to October.

Distribution and habitat. Northern and Southern Oman; in northern Oman on the Jebal

Akhdar mountains, on rocky hillsides and gravel flood plains; in Dhofar, in dry wadis on the north facing low hills. *Altitude*: 100–1700 m. Macaronesia through north and northeast Africa to India. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 164; Collenette, l.c., p. 422.

40. **Chloris** Sw.

Fifty-nine species; tropical and subtropical region of the World.

1. Fertile lemma obliquely obovate in profile, the keel slightly gibbous, with a crown of spreading hairs 1.5–4 mm long just below the tip ..... 3. **C. virgata**
   Fertile lemma lanceolate to obovate-elliptic in profile, not gibbous, without a crown of spreading hairs though often long-or short-ciliate on the margins 2
2. Second lemma clavate, glabrous ..... 2. **C. barbata**
   Second lemma oblong or lanceolate, ciliate on the margins (sometimes obscurely so), the third floret often with a palea and a male flower 3
3. Second lemma oblong, awned; third to fifth lemmas clavate and awned or the fifth reduced to just an awn ..... 1. **C. quinquesetica**
   Second lemma lanceolate, awned; third lemma oblong, awnless; fourth lemma, if present, a minute awnless clavate scale ..... 4. **C. gayana**

1. ***Chloris quinquesetica*** Bhide in J. Asiat. Soc. Bengal, n.s. 8: 311, t. 324 (1912).

Description. Decumbent stoloniferous perennial up to 60 cm high; leaf-blades linear, tapering. Inflorescence a head of 2–8 digitate racemes, these 2.5–5(–8) cm long. Spikelets laterally compressed, with 1 fertile floret, sometimes with a smaller male floret, the rhachilla terminating in 1 or more reduced lemmas; spikelets (4–)5-flowered, (4–)5-awned; fertile lemma obovate-elliptic in profile, 2–3 mm long, densely ciliate on the margins, shortly pilose on the flanks, with an awn 5–8.5 mm long; second lemma oblong, ciliate on the margins above; third to fifth lemmas progressively reduced to clavate glabrous scales or the fifth to an awn only (rarely absent altogether).

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in sand just above sea-level. Not common or under-collected; collected just once from Lower Wadi Sayq west of Rakhyut. Also Pakistan and India. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 165.

2. ***Chloris barbata*** Sw., Fl. Ind. Occid. 1: 200 (1797).

Description. Tufted stoloniferous perennial up to 70 cm high; leaf-blades linear, tapering. Inflorescence a head of 5–7 digitate racemes, these 2–9 cm long. Spikelets 3-flowered, 3-awned; fertile lemma narrowly ovate-elliptic in profile, 1.8–2.2 mm long, sparsely to

densely ciliate on the margins and keel, with an awn 4–5.5 mm long; second and third lemmas reduced to glabrous clavate scales.

Flowering and fruiting. January to June.

Distribution and habitat. Northern Oman, including Musandam, along roadsides, waste places, and cultivated and irrigated areas. *Altitude*: 10–50 m. Throughout the tropics. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 166; Collenette, l.c., p. 362.

3. ***Chloris virgata*** Sw., Fl. Ind. Occid. 1: 203 (1797).
Synonym. C. meccana Hochst. & Steud. ex Schltdl. (1844) – Type: Saudi Arabia, *Schimper* 802 (K).

Description. Annual up to 70 cm high, erect or ascending, occasionally rooting at the lower nodes; leaf-blades linear, tapering. Inflorescence a head of 4–8 digitate racemes, these 2.5–5 cm long. Spikelets 3-flowered, 2-awned; fertile lemma obliquely obovate in profile, the keel slightly gibbous, 2–3.6 mm long, shortly ciliate on the margins and keel, shortly pilose on the flanks, with a crown of spreading hairs 1.5–4 mm long just below the tip, and with an awn 2.5–8.5 mm long; second lemma an oblong glabrous awned scale; third lemma a clavate glabrous awnless scale.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, in wadis in the foothills of Jebal Qamar, on damp sandy soils, and as a weed of cultivation. *Altitude*: 50–550 m. Throughout the tropics. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 167; Collenette, l.c., p. 363.

4. ***Chloris gayana*** Kunth, Révis. Gramin. 1: 293, t. 58 (1830).

Description. Stoloniferous perennial up to 1 m high; leaf-blades linear, tapering. Inflorescence a head of 9–12 digitate racemes, these 3–12 cm long. Spikelets 3- to 4-flowered, 2-awned; fertile lemma lanceolate in profile, 2.9–3.2 mm long, sparsely to densely ciliate on the margins and keel, with an awn 4–5 mm long; second floret with a palea and often a male flower, the lemma lanceolate, ciliate on the margins; third lemma a scabrid oblong or clavate awnless scale; fourth lemma, if present, a glabrous clavate awnless scale.

Flowering and fruiting. October.

Distribution and habitat. Northern and Southern Oman, introduced to Arabia for forage (Rhodes Grass); often found as a weed of roadsides and date groves. *Altitude*: 10–50 m. Tropical and southern Africa. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE.

Distribution map & Illustration. 168; Collenette, l.c., p. 362.

41. **Eustachys** Desv.
About 24 species; Africa, Asia.

Eustachys paspaloides (Vahl) Lanza & Mattei in Boll. Reale Orto Bot. Giardino Colon. Palermo 9: 56 (1910).
Synonym. Cynosurus paspaloides Vahl (1791).

Description. Perennial up to 70 cm high, erect or ascending; leaf-sheaths strongly keeled, obtuse, flabellate, often in bunches in the lower part of the culm. Racemes 2-many, digitate; 2.5–8 cm long. Spikelets laterally compressed, with 1 fertile floret, rarely a smaller male floret, and a rhachilla terminating in a small clavate lemma; upper glume obtuse to 2-lobed at the tip, with a short apical awn; fertile lemma ovate in profile, 1.5–2.1 mm long, keeled, acute to emarginate, cartilaginous to coriaceous, ± ciliate on the keel and lateral veins, awnless or with a very short apical point; second lemma a little smaller, truncate. Caryopsis elliptic in outline, trigonous in section, the pericarp reluctantly free.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains, in monsoon woodland on rocky slopes and in short grassland. *Altitude*: 200–800 m. Tropical and southern Africa. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 169.

42. **Enteropogon** Nees
Seventeen species; tropical and subtropical regions of the World.

Enteropogon dolichostachyus (Lag.) Keng ex Lazarides in Austral. J. Bot., suppl. 5: 31 (1972).
Synonym. Chloris dolichostachya Lag. (1816).

Description. Weak perennial up to 1.2 m high, erect or geniculately ascending, sometimes rooting at the lower nodes. Racemes 4–6(–10), often flexuous and drooping, (7–)15–25 cm long. Spikelets dorsally compressed with 1 fertile floret, sometimes also a smaller male floret, the rhachilla terminating in an awned rudiment or a cluster of rudiments; 2-flowered; fertile lemma 4.5–6.5 mm long, scabridulous, with an awn 10–12 mm long; second lemma an awned rudiment. Caryopsis narrowly elliptic in outline, dorsally compressed, concavo-convex in section, the pericarp free.

Flowering and fruiting. October.

Distribution and habitat. Southern Oman, Dhofar, on limestone and granite outcrops. *Altitude*: 250–850 m. From Pakistan and China to Southeast Asia and northern Australia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 170.

43. **Microchloa** R. Br.
Six species; tropical and subtropical regions of the World.

Microchloa kunthii Desv., Opusc. Sci. Phys. Nat.: 75 (1831).
Synonym. M. indica auct. non (L.) P. Beauv. (1812).

Description. Tufted perennial up to 30 cm high, the base often clothed in the fibrous remains of old leaf-sheaths. Raceme solitary, becoming curved with age, 3.5–11 cm long. Spikelets subterete to subcylindrical, 1-flowered; glumes subequal, enclosing the floret, 2.4–3.8 mm long; lemma 1.6–2.4 mm long, densely keeled, thinly membranous, acute to bilobed at the tip, sometimes mucronulate, ciliate on the margins. Caryopsis ellipsoid.

Flowering and fruiting. October.

Distribution and habitat. Southern Oman, Dhofar, on cliffs and rocky slopes. *Altitude*: 500–800 m. Distributed throughout the tropics. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 171; Collenette, l.c., p. 392.

44. **Cynodon** Rich.
Ten species; Africa, temperate and tropical Asia, Europe, Australasia; introduced elsewhere.

Cynodon dactylon (L.) Pers., Syn. Pl. 1: 85 (1805).
Synonym. Panicum lineare L. (1762).

Description. Stoloniferous sward-forming perennial with slender underground rhizomes; culms slender, up to 40 cm high. Racemes (2–)3–6, digitate, 1.5–6 cm long. Spikelets strongly laterally compressed, 1-flowered, with or without a rhachilla extension (this very rarely bearing a vestigial floret), 2–3 mm long; glumes lanceolate in profile, the upper half to two-thirds the length of the spikelet; lemma as long as the spikelet, keeled, firmly cartilaginous, entire, subglabrous to silky-pubescent on the keel, awnless. Caryopsis elliptic in outline, laterally compressed.

Flowering and fruiting. March to June.

Distribution and habitat. Northern Oman, including Musandam, and Southern Oman, in the foothills of the Western Hajar mountains, on Dhofar mountains, in gravel and sandy places, especially along water courses, moist waste ground, and as a weed of cultivation; occasionally grown for fodder and the most widespread of tropical lawn grasses. *Altitude*: 10–2000 m. Distributed in tropical and warm temperate regions. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, U.A.E., Yemen; also found on Soqotra.

Distribution map & Illustration. 172; Collenette, l.c., p. 366.

45. **Melanocenchris** Nees

Three species; Egypt to NE tropical Africa, Arabian Peninsula to Indian subcontinent; America.

Melanocenchris abyssinica (R.Br. ex Fresen.) Hochst. in Flora 38: 274 (1855).

Synonyms. Eutriana abyssinica R.Br. ex Fresen. (1837); *Ptiloneilema plumosa* Hochst. & Steud. (1854) – Type: Saudi Arabia, *Schimper* 794 (K).

Description. Annual up to 20 cm high. Racemes deciduous, 3–5(–6), 6–14 mm apart, 10–15 mm long including the awns, generally with 1–2 fertile and 2–3 progressively smaller sterile spikelets. Fertile spikelets dorsally compressed, 2-flowered, the upper floret male or sterile, with rhachilla extension. Glumes of lowermost spikelet as long as the raceme, densely ciliate below; lemma chartaceous, fertile lemma (4–)6–7 mm long including the short awns, palea 2-awned.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, Musandam, in areas of cultivation. *Altitude*: ± 150 m. Northeast Africa to Northwest India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

Distribution map & Illustration. 173; Collenette, l.c., p. 391.

46. **Tragus** Haller f.

Eight species; Africa, Europe, tropical and temperate Asia.

Spikelets in a short raceme of 2–4 fertile and 1–2 sterile, separated by distinct internodes, the rhachis prolonged; upper glume 7-veined ..... 1. **T. racemosus**

Spikelets in pairs separated by a distinct internode, the upper shorter than the lower, the rhachis not prolonged; upper glume 5-veined ..... 2. **T. berteronianus**

1. ***Tragus racemosus*** (L.) All., Fl. Pedem. 2: 241 (1785).

Synonyms. Cenchrus racemosus L. (1753); *Tragus brevicaulis* Boiss. (1853) Type: Saudi Arabia, *Schimper* 792 (syntypes, K), and others from Iran and Sudan.

Description. Annual up to 25 cm high. Inflorescence a cylindrical false raceme (2–)5–7.5 cm long; racemelets deciduous, comprising 2–4 fertile and 1–2 sterile spikelets separated by distinct internodes, the rhachis prolonged. Spikelets 1-flowered, 4–5.5 mm long, acuminate; lower glume a minute scale or suppressed; upper glume scarcely exceeding the floret, rounded on the back, 7-veined, the prickles hooked and with turgid or swollen base; lemma acute.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, in low wadis, on sandy and gravelly desert soils and in irrigation channels. *Altitude*: 50–550 m. Southern Europe, temperate Asia and northern tropical Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 174; Collenette, l.c., p. 424.

2. ***Tragus berteronianus*** Schult., Mant. 2: 205 (1824).
Synonyms. T. alienus var. *brevispinus* Henrard (1921) - Type: Saudi Arabia, *Schimper* 793 (syntypes, K), *Kruyt* 31 (whereabouts uncertain).

Description. Annual up to 20 cm high. Inflorescence 2–7.5 cm long; racemelets comprising 2 spikelets separated by a short but distinct internode, the upper shorter than the lower, the rhachis not prolonged. Spikelets 2–3 mm long, acute; upper glume 5-veined, the prickles hooked and with turgid or swollen base.

Flowering and fruiting. February, March; September.

Distribution and habitat. Throughout Oman, on sandy and gravelly desert soils and areas of cultivation. *Altitude*: 50–350 m. Africa, southwest Asia, China and America. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 175; Collenette, l.c., p. 423.

47. **Dignathia** Stapf
Africa, temperate and tropical Asia.

Dignathia hirtella Stapf in Hook.f., Icon. Pl. 30: t. 2950 (1911).

Description. Annual up to 30 cm high, though usually much less. Inflorescence a cylindrical false raceme 2–7 cm long; racemes deciduous, pedunculate, comprising (1–)2 spikelets and a rudiment. Spikelets 1-flowered, suborbicular with rostrate tip, 4–7 mm long; glumes appressed-pubescent on the body, shortly ciliate on the margins, the lower crescent- or S-shaped, the upper with a gibbous body 1.5–2 mm long drawn out into a stiff awn-like beak.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on exposed dry rocky ground. *Altitude*: 100–300 m. Northeast Africa and India. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 176.

48. **Leptothrium** Kunth
Two species: Cape Verde to Egypt and Tanzania, Arabian Peninsula to Pakistan, Caribbean, Colombia to Venezuela.

Leptothrium senegalense (Kunth) Clayton in Kew Bull. 27: 151 (1972).
Synonym. Latipes senegalensis Kunth (1830).

Description. Short-lived perennial up to 75 cm high, forming tussocks. Inflorescence 6–11 cm long; racemes > distant on the wavy main axis, brightly coloured purple and light green;

peduncle cuneate, flattened, 1–4 mm long, ciliate with hooked hairs on margins. First spikelet: lower (outer) glume 3–6.5 mm long, margins ciliate with hooked hairs above; upper glume 3–4 mm long, densely tuberculate and often spinulose, pectinate with hooked spines near one margin, rostrate at the tip. Second spikelet: lower (outer) glume 2.5–4 mm long, tuberculate-spinulose; upper glume 3–3.4 mm long, tuberculate-spinulose, rostrate above and with a crest of hooked bristles; lemma 1-veined, acute.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on sandy and gravel soils, in open grassland and dry wadis. *Altitude*: 50–800 m. Tropical Africa and southwest Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 177; Collenette, l.c., p. 389.

49. **Tetrachaete** Chiov.
A single species; Eritrea to Tanzania, Arabian Peninsula.

Tetrachaete elionuroides Chiov. in Pirotta, Fl. Eritrea: 28, t. 1 (1903).

Description. Wiry annual, up to 25 cm high. Inflorescence a spike-like false raceme 1–3.5 cm long embraced below by the inflated uppermost leaf-sheath, white-plumose; raceme deciduous, comprising 2 sessile contiguous spikelets. Spikelets 1-flowered. Glumes 10–17 mm long, straight, rigid, plumose below; lemma ovate, 2–2.5 mm long, coriaceous, strongly keeled, glabrous, 3-veined, tipped with an awn 3–4.5 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in dry gravel plains. *Altitude*: 10–50 m. Eastern tropical Africa. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 178.

Tribe XIII. PANICEAE R.Br.

1. Spikelets not subtended by deciduous bristles or spines, if subtended by bristles then these persistent on the branches 2
   Spikelets, singly or in clusters, subtended by 1 or more bristles or spines which are deciduous with them 14
2. Upper lemma coriaceous to bony at maturity, with narrow inrolled margins 3
   Upper lemma cartilaginous to chartaceous or rarely hyaline, margins flat and usually hyaline 12
3. Spikelets subtended by persistent bristles or the rhachis prolonged into a subulate point 4
   Spikelets not subtended by bristles nor the rhachis prolonged into a subulate point 5

4. All or most of the spikelets subtended by bristles ..... 57. **Setaria**
   Only the terminal spikelet subtended by a bristle (if lower glume absent see Paspalum) ..... 58. **Paspalidium**
5. Spikelets supported on a globular bead ..... 55. **Eriochloa**
   Spikelets without a supporting bead 6
6. Inflorescence a panicle, not with unilateral racemes ..... 51. **Panicum**
   Inflorescence of unilateral racemes, the spikelets usually single or paired but sometimes in irregular clusters or in short secondary racemes 7
7. Glumes or lemmas awned 8
   Glumes and lemmas awnless, or at most mucronate 9
8. Spikelets laterally compressed, in 2 rows; awns scrabridulous or smooth, often viscid and sticky ..... 50. **Oplismenus**
   Spikelets dorsally compressed, not scrabridulous or sticky ..... 52. **Echinochloa**
9. Lower glume absent ..... 56. **Paspalum**
   Lower glume present 10
10. Tip of upper palea reflexed or slightly protuberant ..... 52. **Echinochloa**
    Tip of upper palea not reflexed 11
11. Upper lemma usually muticous, if shortly mucronate then spikelets plump (if spikelets borne singly then lower glume adaxial) ..... 53. **Brachiaria**
    Upper lemma mucronate; spikelets plano-convex, cuspidate (if spikelets borne singly then lower glume abaxial) ..... 54. **Urochloa**
12. Inflorescence a panicle; spikelets laterally compressed 13
    Inflorescence of racemes, these digitate or borne along an axis; spikelets dorsally compressed ..... 61. **Digitaria**
13. Upper lemma dorsally compressed, the stigmas emerging terminally ..... 59. **Tricholaena**
    Upper lemma laterally compressed, the stigmas emerging laterally ..... 60. **Melinis**
14. Involucral bristles free throughout, ± filiform ..... 62. **Pennisetum**
    Involucral bristles flattened into spines and connate below, often forming a cup ..... 63. **Cenchrus**

50. **Oplismenus** P. Beauv.

Seven species; Tropical and subtropical regions of the World; Caucasus.

Awn scrabridulous ..... 1. **O. burmannii**
Awn smooth and viscid ..... 2. **O. compositus**

1. ***Oplismenus burmannii*** (Retz.) P. Beauv., Ess. Agrostogr.: 54, 168, 169 (1812).
Synonym. Panicum burmanni Retz. (1783.)

Description: Annual with prostrate or trailing culms 10–60 cm long; leaf-blades lanceolate to narrowly ovate, 1–9 cm × 5–20 mm. Inflorescence of unilateral racemes along a central

axis, bearing paired spikelets; inflorescence 2–11cm long; racemes 0.5–2.5 cm long, their rhachis hairy, the spikelets contiguous. Spikelets 2.5–3.5 mm long, pubescent, often with a transverse band of hairs across the middle of the lower lemma, rarely glabrous; glumes with a scrabridulous awn, that of the lower 2.5–20 mm long, that of the upper shorter. Lower floret barren, rarely male, the lemma acute to shortly awned; upper lemma dorsally compressed, acute, indistinctly crested, the margins inrolled and broadly clasping the palea.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, in shaded woodland, in pockets of soil on boulders, and in tall grassland. *Altitude*: 50–550 m. Tropical Africa, tropical Asia and tropical America. Elsewhere in the Arabian Peninsula found on Soqotra.

Distribution map & Illustration. 179.

2. ***Oplismenus compositus*** (L.) P. Beauv., Ess. Agrostogr.: 54, 169 (1812).
Synonym. Panicum compositum L. (1753).

Description. Perennial with rambling culms 15–150 cm long; leaf-blades narrowly lanceolate to narrowly ovate, 2–15 cm × 8–25 mm. Inflorescence 5–25 cm long; lower racemes 2.5–10 cm long, rhachis glabrous to loosely hairy, spikelet-pairs distant (usually 4–12 mm apart). Spikelets 2.5–4 mm long, glabrous to pubescent; glumes with a smooth viscid awn, the longest in each pair of spikelets 3–10 mm.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in shade along roadside on wooded slope on Jebal Qara. *Altitude*: ± 700 m. From East Africa through India to eastern Asia and Australasia; also Mexico, Venezuela and Ecuador. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration. 180.

51. **Panicum** L.
About 466 species; cosmopolitan.

1. Upper lemma rugose ..... 1. **P. maximum**
   Upper lemma quite smooth, rarely finely granulose 2
2. Spikelets 3.5–5 mm long 3
   Spikelets up to 3(–3.6) mm long 4
3. Hispid annual; spikelets persistent ..... 2. **P. miliaceum**
   Glabrous shrubby perennial; spikelets deciduous ..... 3. **P. turgidum**
4. Annual 5
   Perennial 6
5. Spikelets 1–1.5 mm long, asymmetric in profile; lower glume separated from the upper by a short internode; fruit pallid ..... 4. **P. trichoides**

Spikelets 1.8–2.2 mm long, symmetric in profile; glumes adjacent; fruit brown ..... 5. **P. atrosanguineum**

6. Lower glume up to one-third the length of the spikelet ..... 6. **P. coloratum**
Lower glume half to two-thirds the length of the spikelet (if slightly less then margins of glumes broadly membranous) ..... 7. **P. antidotale**

1. ***Panicum maximum*** Jacq., Icon. Pl. Rar. 1: 2, t. 13 (1781).

Synonym. P. atrosanguineum auct. non Hochst. ex A. Rich.; Balfour (1888), in part.

Description. Loosely to densely tufted perennial up to 150(–200) cm high, erect from a shortly rhizomatous base or ascending and rooting at the lower nodes; leaf-blades linear to narrowly lanceolate, 12–40 cm × 4–35 mm. Panicle oblong or triangular in outline, 12–45 cm long, usually much-branched, the branches ascending to spreading, the lowermost in a whorl. Spikelets oblong, 3–4.5 mm long, glabrous or pubescent, blunt or acute; lower glume broadly ovate, one-third to half the length of the spikelet, 3-veined, obtuse or acute; upper lemma and palea conspicuously transversely rugose.

Flowering and fruiting. January, April.

Distribution and habitat. Cultivated for fodder in irrigated date gardens in Northern Oman, in villages in the Western Hajar mountains, and in Wahiba Sands; sometimes found as an escape near habitation in wet and damp places, and in irrigated tree pits. *Altitude*: 50–1500 m. Tropical and southern Africa, but widely introduced in the tropics. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 181; Collenette, l.c., p. 395.

Notes. An extremely variable species in size and indumentum of culms, leaves and panicle.

2. ***Panicum miliaceum*** L., Sp. Pl. 1: 58 (1753).

Description. Robust, sparsely to densely hispid annual up to 150 cm high; leaf-blades linear to narrowly lanceolate, 15–40 cm × 8–24 mm, cordate or amplexicaul at the base. Panicle narrowly oblong to triangular in outline, 15–35 cm long, often appearing 1-sided. Spikelets ovate to ovate-oblong, (4–)4.5–5.5 mm long, glabrous, acute to shortly acuminate; lower glume ovate, half to three-quarters the length of the spikelet, 5-veined, acuminate, separated from the upper by a short internode; upper lemma pale and glossy, often tinged with orange, usually persistent.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, collected from Masirah Island, as a weed of cultivation. *Altitude*: ± 20 m. Originally from the Indian Subcontinent but introduced to parts of Africa, Europe, North & South America, Australia and Central & southern Asia, and widely naturalized. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 182; Collenette, l.c., p. 396.

Notes. Widely cultivated as a hot weather crop in the rainy season, but apparently only a weed in Arabia. It is unlikely that it now exists anywhere as a truly wild plant.

3. ***Panicum turgidum*** Forssk., Pl. Aegypt.-Arab 18 (1775).

Description. Glaucous perennial forming rounded bushes up to 100(–200) cm high and often as much across; culms erect or ascending, woody, branched at the nodes, sometimes forming tufts; leaf-blades linear-lanceolate, (0.5–)2–15 cm × 1–6 mm, flat, folded or inrolled, glabrous and glaucous, stiff and pungent, often much shorter than the sheath, rarely filiform and up to 30 cm long. Panicle triangular in outline, 2.5–15(–30) cm long, lax, branches distant and eventually spreading. Spikelets ovoid, 3.5–4.5(–5) mm long, glabrous, acute or acuminate, turgid and often gaping at anthesis; lower glume broadly ovate, three-quarters as long to almost as long as the spikelet, 5- to 9-veined; upper lemma pallid, smooth and shining.

Flowering and fruiting. January to October.

Distribution and habitat. Throughout Oman, on sandy plains and deserts, often on saline soils, in desert on dunes and on coastal dunes, and in sandy pockets in rocky outcrops; common and a component of sandy desert vegetation. *Altitude*: 0–500 m. Morocco, Ethiopia, Somalia and Sudan eastwards to Southwest Asia and Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 183; Collenette, l.c., p. 396.

4. ***Panicum trichoides*** Sw., Prodr.: 24 (1788).

Description. Delicate annual with slender decumbent or ascending culms up to 100 cm long; leaf-blades lanceolate to narrowly ovate, 3–7 cm × 5–20 mm, cordate or asymmetrically narrowed at the base, thin, pilose, acuminate. Panicle ovate-oblong in outline, 6–16 cm long, finely branched. Spikelets ovate, asymmetric in profile, 1–1.5 mm long, sparsely to densely pubescent, blunt; lower glume broadly ovate, up to half the length of the spikelet, 1-veined, acute, separated from the upper by a short internode; upper lemma pallid, finely granulose.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, on the escarpment mountains, under trees or in the shade of taller grasses. *Altitude*: 80–600 m. Tropical America; probably introduced into the Old World. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 184.

5. ***Panicum atrosanguineum*** Hochst. ex A. Rich. (1850 p. 375).

Description. Annual up to 40 cm high, ascending; leaf-blades lanceolate, 6–14 cm × 5–14 mm, straight at the base, pilose or hispid with tubercle-based hairs, acute. Panicle ovate

or oblong in outline, branches fine and spreading. Spikelets ovate-oblong, 1.8–2.2 mm long, glabrous, often tinged with purple, shortly acuminate; lower glume broadly ovate, two-thirds the length of the spikelet, 3- to 5-veined, acuminate; upper lemma dark brown, smooth and glossy.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, in deciduous bushland and in areas of cultivation. *Altitude*: 150–350 m. Tropical Africa and northwest India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 185; Collenette, l.c., p. 395.

6. ***Panicum coloratum*** L., Mant. Pl. 1: 30 (1767).

Description. Tufted, pubescent or subglabrous perennial, the base usually knotty or slightly swollen, often with persistent scales; culms erect, up to 100 cm high, sometimes more, rarely decumbent; leaves not distichous, the blades linear, (3–)12–30 cm × (2–)5–10 mm, straight or subamplexicaul at the base, flat, glabrous or hairy, acute to acuminate, not pungent. Panicle ovate in outline, 4–30 cm long, usually much-branched, contracted or spreading, the branches ascending. Spikelets ovate-elliptic, 2–3 mm long, green, often tinged with purple, obtuse, acute or occasionally acuminate; lower glume ovate, a quarter to a third the length of the spikelet, membranous, 1(–3)-veined, cuff-like, clasping, acute; upper lemma pallid, smooth and glossy.

Flowering and fruiting. February, March.

Distribution and habitat. Northern Oman, in date plantations in foothills of the Western Hajar mountains, in sandy and muddy stream beds and under shrubs along their banks. *Altitude*: 250–660 m. Tropical and subtropical Africa; introduced elsewhere. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 186; Collenette, l.c., p. 395.

Notes. A variable species, particularly with respect to height, indumentum, leaf-blade length and width, panicle size and spikelet length.

7. ***Panicum antidotale*** Retz., Observ. Bot. 4: 17 (1786/7).

Description. Perennial with creeping woody rootstock; culms woody, pubescent at the base, up to 180 cm high, erect or ascending, often prunose below; leaf-blades linear, 6–30 cm × 4–14 mm, flat, glabrous, acute. Panicle narrowly triangular to broadly oblong or ovate in outline, 13–32 cm long, varying from copiously branched with the branches subverticillate to sparingly branched with the spikelets condensed about the distant branches. Spikelets elliptic, 2.4–3.2(–3.6) mm long, glabrous, acute; lower glume broadly ovate, half to two-thirds the length of the spikelet (rarely less), membranous with broad hyaline margins, 3- to 5-veined, acute; upper lemma pallid, smooth and glossy.

Flowering and fruiting. June, July; September.

Distribution and habitat. Northern and Southern Oman; as a weed of roadsides and cultivated areas in northern Oman and amongst shrubs on limestone hills in Dhofar. *Altitude*: 10–550 m. Egypt and Iraq eastwards to Pakistan and India; introduced into tropical Africa as a drought-resistant fodder grass. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 187; Collenette, l.c., p. 394.

52. **Echinochloa** P. Beauv.
Thirty-four species; cosmopolitan.

Echinochloa colona (L.) Link, Hort. Berol. 2: 209 (1833
Synonym. Panicum colonum L. (1759).

Description. Annual; culms up to 100 cm high, erect or ascending; ligule absent. Inflorescence typically linear, 1–15 cm long, the racemes neatly 4-rowed; racemes seldom over 3 cm long, simple, commonly half their length apart and appressed to the axis, but sometimes subverticillate and spreading (rarely forming a lanceolate head, but then the spikelets purplish with the lower floret male). Spikelets ovate-elliptic to subglobose, 1.5–3(–3.5) mm long, pubescent (rarely shortly hispid); lower floret male or barren, the lemma acute to cuspidate (rarely with a subulate point up to 1 mm long); upper lemma 2–3 mm long.

Flowering and fruiting. February to September.

Distribution and habitat. Throughout Oman, in moist sand, by irrigation channels and as a weed of cultivation; common. *Altitude*: 10–250 m. Throughout the tropics and subtropics. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 188; Collenette, l.c., p. 372.

Notes. A second species, *Echinochloa crusgalli* (L.) P. Beauv. (1812), native to Yemen and Saudi Arabia, best distinguished by the untidy racemes of acuminate or awned, hispid spikelets, is unconfirmed in Oman, but may be found there; it is probably introduced in the UAE.

53. **Brachiaria** (Trin.) Griseb.
About 119 species; tropical and subtropical regions of the world.

1. Upper lemma smooth, glossy, obtuse, deciduous; spikelets neatly imbricate; lower glume up to one-fifth the length of the spikelet ..... 6. **B. eruciformis**
   Upper lemma granulose to rugose, subacute to mucronate, not separately deciduous .. 2
2. Glumes separated by a distinct internode; upper lemma coarsely rugose; racemes slender, distant, second ..... 5. **B. leersioides**
   Glumes adjacent, or if slightly separated then the upper lemma not coarsely rugose ... 3

3. Racemes compound, bearing the spikelets in dense fascicles or on short branchlets .. .. 4. **B. deflexa**
   Racemes simple, the spikelets borne singly or in pairs, exceptionally the longest racemes with a few branchlets 4
4. Upper glume and lower lemma thinly cartilaginous, usually smooth and glossy but sometimes papillose-pubescent; spikelets 2.5–4.5 mm long, obtuse to subacute .... 1. **B. ovalis**
   Upper glume and lower lemma membranous, glabrous or pubescent 5
5. Margins of leaf-blades ciliate with tubercle-based hairs towards the rounded base; spikelets subsessile; upper lemma mucronate ..... 2. **B. lata**
   Margins of leaf-blades not ciliate below with tubercle-based hairs; one of each pair of spikelets clearly pedicelled; upper lemma not mucronate ..... 3. **B. ramosa**

1. ***Brachiaria ovalis*** Stapf in Prain, Fl. trop. Afr. 9: 546 (1919) Type: Socotra, *Balfour* 47 (holo. K).

Description. Annual up to 50 cm high, often densely pubescent; leaf-blades broadly linear to narrowly lanceolate. Inflorescence of 3–15 spreading or appressed racemes on an axis 4–15 cm long; racemes 3–7 cm long, bearing single or paired spikelets loosely spaced on a triquetrous rhachis; pedicels shorter than the spikelets. Spikelets elliptic, 2.5–4.5 mm long, glabrous or papillose-pubescent, obtuse to subacute, with a stipe 0.3–0.7 mm long; lower glume a quarter to half the length of the spikelet, broadly ovate; upper glume and lower lemma thinly cartilaginous, smooth and glossy; upper lemma granulose to rugulose, as long as or slightly shorter (by up to 1 mm) than the spikelet, subacute to mucronulate.

Flowering and fruiting. May.

Distribution and habitat. Northern Oman, on the Jebal Akhdar range, on rocky hillsides, and in fissures in exposed limestone pavement. *Altitude*: ± 1040 m. Also Kenya, Sudan and Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 189; Collenette, l.c., p. 353.

2. ***Brachiaria lata*** (Schumach.) C.E. Hubb. in Hook., Icon. Pl. 34: t. 3363 (1938). *Synonym. Panicum latum* Schumach. (1827).

Description. Annual up to 100 cm high, erect or geniculately ascending; leaf-blades broadly linear to lanceolate, rounded at the base, cartilaginous on the margins, the latter ciliate below with tubercle-based hairs. Inflorescence of 6–16 racemes on an axis 4–10 cm long; racemes 1.5–4 cm long, bearing paired subsessile spikelets closely spaced on a triquetrous rhachis; pedicels 0.3–0.8 mm long. Spikelets elliptic to broadly elliptic, 2.5–3(–3.5) mm long, glabrous, acute to cuspidate, without a stipe; lower glume a third to half the length of the spikelet, broadly ovate to ovate; upper glume and lower lemma membranous; upper lemma rugose, conspicuously mucronate.

Flowering and fruiting. July, September.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains, on wooded hillsides with *Delonix*, *Commiphora*. *Altitude*: 200–800 m. Western tropical Africa eastwards to Ethiopia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 190; Collenette, l.c., p. 353.

3. ***Brachiaria ramosa*** (L.) Stapf in Prain, Fl. trop. Afr. 9: 542 (1919).
Synonym. Panicum ramosum L. (1767).

Description. Annual up to 70 cm high; leaf-blades broadly linear. Inflorescence of 3–15 racemes on an axis 3–10 cm long; racemes 1–8 cm long, simple or the longest with branchlets at the base, bearing mostly paired, loosely contiguous spikelets appressed to the triquetrous rhachis; pedicels shorter than the spikelets, 1–2 mm long. Spikelets elliptic to broadly elliptic, 2.5–3.5 mm long, glabrous or pubescent, acute to cuspidate, with or without a stipe up to 0.5 mm long; lower glume a third to half the length of the spikelet; upper glume and lower lemma membranous, or rarely the latter coriaceous; upper lemma rugose, subacute to acute.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on escarpment mountains and rocky coastal areas, in tall grassland and semi-desert scrub. *Altitude*: 50–450 m. Tropical Africa southwards to South Africa; tropical Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 191; Collenette, l.c., p. 353.

4. ***Brachiaria deflexa*** (Schumach.) C.E. Hubb. ex Robyns in Bull. Jard. Bot. État 9: 181 (1932).
Synonym. Panicum deflexum Schumach. (1827).

Description. Annual up to 70 cm high, often weak and ascending; leaf-blades broadly linear. Inflorescence of 7–15 racemes on an axis 6–15 cm long; racemes 2–10 cm long, often compound, bearing mostly paired spikelets spreading from the triquetrous rhachis, the inflorescence imitating a panicle; pedicels, or some of them, longer than the spikelets, up to 15 mm long. Spikelets broadly elliptic, 2.5–3.5 mm long, glabrous to pubescent, acute, with a short stipe up to 0.5 mm long; lower glume a third to half the length of the spikelet; upper glume ± adjacent to the lower; upper lemma rugose, subacute to acute.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, foothills of the escarpment mountains, in shade on hillside, coastal wadi banks in sandy and gravelly soils. *Altitude*: 0–200 m. Tropical and southern Africa and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 192; Collenette, l.c., p. 351.

5. ***Brachiaria leersioides*** (Hochst.) Stapf in Prain, Fl. trop. Afr. 9: 551 (1919).
Synonym. Panicum leersioides Hochst. (1855).

Description. Annual up to 100 cm high, ascending; leaf-blades linear, setaceously acuminate. Inflorescence of 3–14 widely spaced racemes, these spreading horizontally or deflexing at maturity, borne on an axis 3–20 cm long; racemes 1–7 cm long, slender, secund, bearing paired spikelets on a triquetrous rhachis. Spikelets narrowly elliptic, 2–3.5 mm long, glabrous, subacute, without a stipe; lower glume a third to half the length of the spikelet, clasping; upper glume separated from the lower by a distinct internode 0.2–0.5 mm long; upper lemma coarsely rugose, subacute.

Flowering and fruiting. July.

Distribution and habitat. Northern and Southern Oman, on sandy and gravelly plains. *Altitude*: ± 350 m. Tropical Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 193; Collenette, l.c., p. 352.

6. ***Brachiaria eruciformis*** (Sm.) Griseb. in Ledeb., Fl. Ross. 4: 469 (1853).
Synonym. Panicum eruciforme Sm. in Sibth. & Sm. (1806).

Description. Annual up to 60 cm high, slender, geniculately ascending; leaf-blades linear to narrowly lanceolate, glabrous or pubescent. Inflorescence of 3–14 racemes on an axis 1–8 cm long; racemes 0.5–2.5 cm long, secund, bearing single spikelets imbricate on a triquetrous rhachis. Spikelets elliptic, 1.7–2.7 mm long, pubescent, subacute, without a stipe; lower glume up to a fifth the length of the spikelet; upper glume adjacent to the lower; upper lemma readily deciduous, smooth and glossy, obtuse.

Flowering and fruiting. January; July, September.

Distribution and habitat. Northern and Southern Oman, by irrigation channels and as a weed of cultivation. *Altitude*: 50–2000 m. Mediterranean region southwards to South Africa and eastwards to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 194; Collenette, l.c., p. 352.

54. **Urochloa** P. Beauv.
Sixteen species; Europe, Africa, temperate and tropical Asia, Australasia, Pacific, North and South America.

Urochloa panicoides P.Beauv., Ess. Agrostogr.: 53, t. 11/1 (1812).

Description. Annual up to 100 cm high, often ascending from a prostrate rooting base; ligule a line of hairs; leaf-blades linear to narrowly lanceolate, subamplexicaul, coarse, glabrous

or pubescent, the margins tuberculate-ciliate at least near the base. Inflorescence of 2–7 racemes on an axis 1–9 cm long; racemes 1–7 cm long, bearing single or paired spikelets on a narrowly winged rhachis. Spikelets elliptic, (2.5–)3.5–4.5(–5.5) mm long, acute; lower glume ovate, a quarter to half the length of the spikelet, 3- to 5-veined, obtuse to subacute; lower lemma sometimes with a setose fringe; upper lemma rugulose, with a mucro 0.3– 1 mm long. Caryopsis broadly elliptic to subrotund in outline, strongly dorsally flattened.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains, in damp grassland, and by shady cliffs. *Altitude*: 0–550 m. Eastern tropical Africa southwards to South Africa; India; introduced in Australia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 195.

55. **Eriochloa** Kunth

Thirty-four species; cosmopolitan.

Eriochloa fatmensis (Hochst. & Steud.) Clayton in Kew Bull. 30: 108 (1975).
Synonym. Panicum fatmense Hochst. & Steud., Exsicc. (Pl. Schimp.) 1837: 806 1837 – Type: Saudi Arabia, *Schimper* 806 (K).

Description. Annual up to 120 cm high, erect or geniculately ascending; ligule a line of hairs; leaf-blades linear. Inflorescence 3–20 cm long; racemes 1–5 cm long, the rhachis puberulous, triquetrous or narrowly winged, the spikelets paired. Spikelets lanceolate, (2.5–)3–5 mm long, thinly pubescent; lower glume absent; upper glume attenuate to an awnlet 0.5–4 mm long; lower floret without a palea; upper lemma with a mucro 0.3–1 mm long. Caryopsis oblong-elliptic in outline, dorsally compressed, obtuse.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on sandy soils and weedy places. *Altitude*: 0–500 m. Tropical Africa and South Africa; a few records from India and Thailand. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 196; Collenette, l.c., p. 383.

56. **Paspalum** L.

About 324 species; Africa, tropical and subtropical Asia to Pacific, North and South America.

Spikelets ovate, plumply plano-convex; upper glume and lower lemma somewhat coriaceous; upper glume minutely pubescent ..... 1. **P. distichum**
Spikelets narrowly ovate-elliptic, markedly flattened; upper glume and lower lemma thinly chartaceous; upper glume glabrous ..... 2. **P. vaginatum**

1. ***Paspalum distichum*** L., Syst. Nat., ed. 10, 2: 855 (1759).

Description. Creeping stoloniferous perennial up to 50 cm high. Leaf-blades linear to narrowly lanceolate; ligule a short membrane. Inflorescence of 2(–4) conjugate racemes, the spikelets borne singly in 2 rows on a winged rhachis 1–2 mm wide. Spikelets ovate, 2.5–3.5 mm long, plumply plano-convex, acute or subacute, pallid or pale green; lower glume often present as a minute scale; upper glume herbaceous, appressed-pubescent, with a distinct midvein; lower lemma similar to the upper glume but glabrous; upper lemma smooth, pallid at maturity. Caryopsis plano-convex.

Flowering and fruiting. September.

Distribution and habitat. Southen Oman, Dhofar, in damp, shady places, by streams. *Altitude*: ± 450 m. Tropics and subtropics throughout the world, but absent from the equatorial belt and extending into warm temperate regions. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 197; Collenette, l.c., p. 398.

2. ***Paspalum vaginatum*** Sw., Prodr.: 21 (1788).
Synonym. P. distichum auct. non L.

Description. Creeping stoloniferous perennial up to 60 cm high. Leaf-blades linear to narrowly lanceolate; ligule a short membrane. Inflorescence of 2(–5) conjugate racemes, the spikelets borne singly in 2 rows on a winged rhachis 1–2 mm wide. Spikelets narrowly ovate-elliptic, 3–4 mm long, markedly flattened, acute, usually pale brownish green; lower glume very rarely present as a minute scale; upper glume and lower lemma thinly chartaceous, glabrous, the midvein often suppressed; upper lemma smooth, pallid at maturity. Caryopsis plano-convex.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, on the escarpment mountains in monsoon-effected woodland, by brackish water pools and in ditches; sometimes planted as a lawn grass or growing as a weed in lawns; a dominant grass around saline and brackish pools. *Altitude*: 0–250 m. Throughout the tropics and extending into the subtropics. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, U.A.E., Yemen; also found on Soqotra.

Distribution map & Illustration. 198; Collenette, l.c., p. 398.

57. **Setaria** P. Beauv. (*nom. conserv.*)
About 102 species; cosmopolitan except Antartica.

1. Panicle spike-like, sometimes ± lobed; leaf-blades not sagittate 2
   Panicle clearly branched ..... 4. **S. intermedia**
2. Bristles retrorsely barbed, adhering tenaciously to clothing or fur; panicle untidily lobed ..... 1. **S. verticillata**

Bristles antrorsely barbed 3

3. Upper glume as long as the upper lemma, the latter finely rugose ..... 2. **S. viridis**
Upper glume shorter than the upper lemma, the latter strongly rugose to corrugate, rarely almost smooth ..... 3. **S. pumila**

1. ***Setaria verticillata*** (L.) P. Beauv., Ess. Agrostogr.: 51, 178 (1812).
Synonyms. Panicum verticillatum L. (1762); *P. adhaerens* Forssk. (1775, p. 20) – Type: Yemen, *Forsskal* (LD); *S. verticilliformis* Dumort., (1827); Ghazanfar, Annot. Cat. Vasc. Pl. Oman: 138 (1992); *S. adhaerens* (Forssk.) Chiov. (1919); *Setaria viridis* auct. non (L.) P. Beauv.; Balfour (1888, p. 312).

Description. Annual up to 100 cm high, geniculately ascending; leaf-blades broadly linear. Panicle contracted, spike-like, linear to untidily lobed, 2–15 cm long, often entangled, the rhachis hispidulous; bristles 3–8 mm long, retrorsely barbed, tenaciously clinging to clothing or fur. Spikelets elliptic, 1.5–2.5 mm long; lower glume a third to half the length of the spikelet; upper glume as long as the spikelet; lower floret barren, the palea minute; upper lemma finely rugose.

Flowering and fruiting. February to April.

Distribution and habitat. Throughout Oman, in damp and shady places, mostly in cultivated or overgrazed areas. *Altitude*: 0–1800 m. Tropical and warm temperate regions throughout the world. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 199; Collenette, l.c., p. 410.

Notes. The species is recognized at once by the tenaciously clinging bristles of the inflorescence. Forms with mostly antrorse barbs on the bristles but retaining the untidily lobed panicle have been interpreted as a hybrid between this species and *S. viridis*. However, since the two forms occur in mixed populations from which the latter species is absent, this is now thought to be unlikely and such forms are included in *S. verticillata*.

2. ***Setaria viridis*** (L.) P. Beauv., Ess. Agrostogr.: 51, 171, 178 (1812).
Synonym. Panicum viride L. (1759).

Description. Annual up to 50 cm high, erect or geniculately ascending; leaf-blades broadly linear to narrowly lanceolate, rounded at the base. Panicle contracted, spike-like, linear or sometimes ± lobed below, 2–12 cm long, the rhachis puberulous to hispidulous; bristles 3–12 mm long, antrorsely barbed. Spikelets elliptic, 2–2.5(–3) mm long; lower glume a quarter to a third the length of the spikelet; upper glume as long as the spikelet; lower floret barren, the palea about half as long as the lemma; upper lemma finely rugose.

Flowering and fruiting. May; October.

Distribution and habitat. Northern and Southern Oman, in damp and shady places, in grassland on the escarpment mountains in Dhofar, and in cultivated or overgrazed areas.

Altitude: 0–800 m. Old World temperate regions; introduced in the New World. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration. 200; Collenette, l.c., p. 411.

3. ***Setaria pumila*** (Poir.) Roem. & Schult., Syst. Veg. 2: 891 (1817).
Synonym. Panicum pumilum Poir. (1816).

Description. Annual up to 130 cm high, ascending; leaf-blades linear. Panicle contracted, spike-like, cylindrical, 1–10(–20) cm long, the rhachis tomentellous; bristles 3–12 mm long, antrorsely scabrid, commonly fulvous. Spikelets ovate, 1.5–2.5 mm long; lower glume a third to half the length of the spikelet; upper glume similar to the lower; lower floret male or barren, the palea almost as long as the lemma; upper lemma rugose to corrugate, rarely almost smooth.

Flowering and fruiting. July; September, October.

Distribution and habitat. Northern and Southern Oman, on wooded hillsides, open grassland and moist or shady places, cultivated fields and gardens, and in areas of heavy grazing. *Altitude*: 100–1800 m. Tropical and warm temperate regions of the Old World. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 201; Collenette, l.c., p. 410.

4. ***Setaria intermedia*** Roem. & Schult., Syst. Veg. 2: 489 (1817).

Description. Annual up to 100 cm high, ascending, often decumbent below and rooting from the nodes; leaf-blades broadly linear. Panicle contracted, 3–12 cm long, narrowly lanceolate in outline, branched at least below, the rhachis scabridulous to puberulous; bristles 3–10 mm long, stiff, obscurely scabridulous. Spikelets broadly elliptic, 1.5–2 mm long; lower glume a third to half the length of the spikelet; upper glume half to two-thirds the length of the spikelet; lower floret barren, the palea almost as long as the lemma; upper lemma rugose, pallid to golden.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, on the escarpment mountains in monsoon-affected woodland. *Altitude*: 120–650 m. India, Myanmar and Sri Lanka; introduced in East Africa. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration. 202.

58. **Paspalidium** Stapf
Thirty-four species; tropical and subtropical regions of the Old World to central U.S.A.

Plant creeping, with spongy stolons; raceme rhachis narrowly winged, often ciliate ..... 1. **P. geminatum**

Plant tufted from a knotty base or sometimes with hard stolons; raceme rhachis triquetrous, glabrous or puberulous ..... 2. **P. desertorum**

1. ***Paspalidium geminatum*** (Forssk.) Stapf in Prain, Fl. trop. Afr. 9: 583 (1920).
Synonym. Panicum geminatum Forssk. (1775).

Description. Perennial up to 60 cm high, with creeping or floating spongy stolons, the culms prostrate and rooting at the lower nodes. Leaf-blades linear; ligule a line of hairs. Inflorescence 5–30 cm long; racemes 0.5–4 cm long, contiguous and less than their own length apart (the lowermost usually remote), the rhachis narrowly winged, 0.5–1 mm wide, usually shortly ciliate. Spikelets ovate, 1.6–2.6 mm long; lower glume truncate, a quarter to a third the length of the spikelet; upper glume two-thirds to four-fifths the length of the spikelet; upper lemma granulose.

Flowering and fruiting. January.

Distribution and habitat. Northern Oman, Wahiba Sands, in wet sandy soil by permanent flowing stream. *Altitude*: ± 30 m. Throughout the Old World tropics. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 203; Collenette, l.c., p. 397.

2. ***Paspalidium desertorum*** (A. Rich.) Stapf in Prain, Fl. trop. Afr. 9: 585 (1920)
Synonyms. Panicum desertorum A. Rich. (1850); *P. arabicum* Nees ex Steud. (1854) – Type: Saudi Arabia, *Schimper* 807 (holo. K) (the second specimen cited, *Schimper* 963, is *Echinochloa colona* and does not fit the description).

Description. Tufted perennial from a knotty base, the culms up to 60 cm high, erect or geniculately ascending, sometimes decumbent to form hard stolons. Leaf-blades linear; ligule a line of hairs. Inflorescence 4–20 cm long; racemes 0.5–3 cm long, contiguous and less than their own length apart (the lowermost usually remote), the rhachis triquetrous, 0.2–0.4 mm wide, glabrous to puberulous. Spikelets ovate, 1.7–2.6 mm long; lower glume obtuse to truncate, a third to half the length of the spikelet; upper glume three-quarters as long to as long as the spikelet; upper lemma granulose to weakly rugulose.

Flowering and fruiting. March; September.

Distribution and habitat. Northern and Southern Oman, on silty soil, as a weed of cultivation. *Altitude*: 0–50 m. Kenya, Sudan, Ethiopia and Somalia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 204; Collenette, l.c., p. 397.

59. **Tricholaena** Schult.
Four species; Europe, Africa, temperate and tropical Asia.

Tricholaena teneriffae (L.f.) Link, Handbuch 1: 91 (1829)
Synonyms. Saccharum teneriffae L.f., (1782); *Trichlolaena mascatensis* Gand. Type: Oman, *Aucher-Eloy* 5447 (iso. K, P).

Description. Perennial, forming tussocks from a woody rootstock, up to 60 cm high, ascending, the culms wiry with narrow leaf-blades or herbaceous and leafy; leaf-blades rigid, glaucous, flat or inrolled, glabrous or thinly pubescent; ligule a line of hairs. Panicle usually narrowly oblong, 3–15 cm long, fairly dense. Spikelets 2.5–3.5 mm long; lower glume a minute truncate scale (rarely up to 0.5 mm); upper glume ovate, tuberculate-pilose with white hairs extending 0.5–4 mm beyond the tip, but often glabrous in the upper quarter, acute and usually mucronate.

Flowering and fruiting. March, June; September.

Distribution and habitat. Northern Oman, Musandam, and Southern Oman, on sandy and gravelly soils, and as a weed in date gardens. *Altitude*: 0–350 m. Eastern tropical Africa northwards to the Mediterranean region, westwards to Macaronesia and eastwards to India. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 205; Collenette, l.c., p. 424.

60. **Melinis** P.Beauv.
Rhynchelytrum Nees
Twenty-two species; Africa, Arabian Peninsula.

Melinis repens (Willd.) Zizka subsp. ***grandiflora*** (Hochst.) Zizka in Biblioth. Bot. 138: 60 (1988).
Synonyms. Rhynchelytrum grandiflorum Hochst. (1844); *Rhynchelytrum microstachyum* Balfour (1884) – Type: Socotra, *Balfour* 254 (K); *R. microstachyum* var. *albicomum* Balfour (1884) – Type: Socotra, *Balfour* 124 (K) & *Schweinfurth* 467 (K); *Melinis barbeyana* Mez (1921) – Type: Yemen, *Schweinfurth* 1345 (B).

Description. Annual or short-lived perennial up to 90 cm high. Panicle ovate to oblong in outline, (6–)8–15 cm long, fluffy, silvery pink or purple. Spikelets ovate, (4–)5–12 mm long, usually villous with hairs extending 1–4 mm beyond the tip; lower glume narrowly oblong, (0.6–)1.5–3(–4.3) mm long, separated from the upper by an internode (0.5–)0.7–1.7(–2) mm long; upper glume conspicuously gibbous, chartaceous, tapering to a glabrous membranous beak a quarter to half its length, emarginate at the tip, mucronate or with an inconspicuous awn up to 7(–10)mm long; lower lemma narrower and less gibbous than the upper glume; palea ciliate on the keels.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, in silty and stony wadi beds. *Altitude*: 0–650 m

Tropical Africa. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 206; Collenette, l.c., p. 392.

61. **Digitaria** Haller f.
About 260 species; cosmopolitan.

1. Rhachis of racemes stiffly radiating, plumose below, bare of spikelets in the lower half ..... 4. **D. pennata**
   Rhachis of racemes not plumose, bearing spikelets to the base 2
2. Spikelets regularly in groups of 3; pedicel with a crown of short hairs .. 1. **D. stricta**
   Spikelets in pairs (rarely in threes but then silky-villous) 3
3. Plant perennial 4
   Plant annual 5
4. Central axis of the inflorescence longer than the racemes ..... 3. **D. neghellensis**
   Central axis of the inflorescence shorter than the racemes ..... 4. **D. nodosa**
5. Racemes diverging from a central axis (this seldom exceeding the longest raceme), delicate, the spikelets loosely imbricate; spikelets 1.5–2.1 mm long ..... 5. **D. velutina**
   Racemes digitate or with a very short central axis in robust specimens, the spikelets closely imbricate; spikelets 2.5–3.3 mm long ..... 6. **D. ciliaris**

1. ***Digitaria stricta*** Roth ex Roem. & Schult., Syst. Veg. 2: 474 (1817).

Description. Annual up to 40(–110) cm high; leaf-blades broadly linear, ± hirsute with tubercle-based hairs, or subglabrous. Inflorescence of 3–6(–17) racemes, these subdigitate or arranged along a short axis; racemes 4–14 cm long, the spikelets in threes on a narrowly winged rhachis with triquetrous midrib; pedicels narrowly winged, slightly dilated at the tip, with a crown of stiff hairs exceeding the tip and sometimes up to 1 mm long. Spikelets oblong-elliptic or narrowly obovate, 0.9(–1.4) mm long, obtuse; lower glume absent; upper glume absent or very short to about a third the length of the spikelet and 3-veined, covered all over with short clavate hairs or glabrous; lower lemma as long as the spikelet, (3–)5-veined, all interspaces with a sparse to very dense covering of clavate hairs. Fruit elliptic in outline, apiculate, chestnut-brown to black.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains, in open grassland. *Altitude*: 50–800 m. Pakistan, India, Nepal, Myanmar and Sri Lanka. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 207.

Notes. All Arabian material has spikelets less than 1 mm long and no upper glume, rather extreme when compared with specimens from elsewhere, but doubtless the same species.

2. ***Digitaria pennata*** (Hochst.) T. Cooke, Fl. Bombay 2: 941 (1908).
Synonym. Panicum pennatum Hochst. (1855).

Description. Tufted perennial up to 100 cm high, the culms wiry above, woody below, almost suffrutescent, the base bulbous and clad in silky-pubescent scales; leaf-blades narrowly lanceolate. Inflorescence of 4–14 long stiff radiating racemes in 1 or 2 whorls, the whole inflorescence breaking off at maturity; racemes 7–25 cm long with slender triquetrous rhachis, the lower half bare of spikelets and plumose, the upper half bearing distant pairs of appressed spikelets. Spikelets lanceolate, 2.5–3 mm long; lower glume a minute hyaline truncate scale; upper glume as long as the spikelet, 3-veined, pubescent between the veins; lower lemma as long as the spikelet, coarsely ribbed with 7 evenly spaced veins, finely pubescent between the veins (rarely pilose or glabrous). Fruit narrowly elliptic in outline, chestnut-brown.

Flowering and fruiting. July.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains in open grassland. *Altitude*: ± 800 m. Kenya, Tanzania, Ethiopia and Somalia to northern India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 208; Collenette, l.c., p. 370.

3. ***Digitaria neghellensis*** J.-P. Lebrun in Bull. Mus. Hist. Nat. (Paris), sér. 4, 10, sect. B, Adansonia no. 3: 271 (1989).

Description. Tufted perennial up to 70 cm high, the culms often slightly swollen at the base; leaf-blades lanceolate, subamplexicaul, densely grey-tomentose. Inflorescence of 4–5 racemes, these borne on an elongated central axis up to 13 cm long; racemes 6–12 cm long, the spikelets mostly in pairs (occasionally in groups of 3 at the base of the raceme) on a triquetrous rhachis, those of a pair distinctly and unequally pedicellate. Spikelets elliptic, 2.5–3 mm long; lower glume an ovate scale up to 0.5 mm long; upper glume as long as the spikelet, 3(–5)-veined, densely silky-villous with long silvery hairs extending 2–4 mm beyond the tip of the spikelet; lower lemma similar to the upper glume. Fruit lanceolate in outline, deep violet-brown.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on dry limestone hillsides in the *Euphorbia balsamifera* zone. *Altitude*: 450–1200 m. Also in Ethiopia. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 209.

Notes. The densely grey-tomentose foliage and silky-villous spikelets make this species quite unmistakable.

4. ***Digitaria nodosa*** Parl., Pl. Nov.: 39 (1842).
Synonym. Panicum commutatum var. *nodosum* (Parl.) Hack. ex T.Durand & Schinz (1895)

Description. Tufted perennial without rhizomes, the basal leaf-sheaths silky-pubescent to tomentose; culms up to 100 cm high, usually bulbous at the base; leaf-blades linear. Inflorescence of 2–12 racemes, these digitate or borne along an axis up to 7.5 cm long; racemes 3–15 cm long, the spikelets paired on a triquetrous rhachis. Spikelets narrowly elliptic, 2–3 mm long; lower glume an ovate scale 0.1–0.4 mm long; upper glume two-thirds as long to almost as long as the spikelet, 3-veined, glabrous or pubescent to villous; lower lemma as long as the spikelet, 7-veined, glabrous to pilose or woolly-villous. Fruit elliptic in outline, greyish to light brown.

Flowering and fruiting. February to May; September, October.

Distribution and habitat. Northern and Southern Oman, on the Jebal Akhdar range in northern Oman, and on low exposed hills in Dhofar, on clay soils amongst boulders, rocky slopes and wooded hillsides. *Altitude*: 50–2800 m. Canary Islands and North Africa; north-eastern tropical Africa eastwards to Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 210; Collenette, l.c., p. 370.

Notes. A number of specimens from Dhofar have glabrous or almost glabrous spikelets, an unusual condition in the species. The swollen culm bases, hairy basal leaf-sheaths and lack of rhizomes indicate that these are more likely to be extreme specimens of *D. nodosa* than any other taxon known from tropical Africa or India. Variation between the normal and extreme conditions is more or less continuous and it therefore seems better to accommodate these specimens in *D. nodosa* than in any segregate taxon.

5. ***Digitaria velutina*** (Forssk.) P. Beauv., Ess Agrostogr.: 51 (1812).
Synonym. Phalaris velutina Forssk. (1775) – Type: Yemen, *Forsskal* (C).

Description. Annual up to 80 cm high, geniculately ascending, often decumbent and rambling; leaf-blades broadly linear to lanceolate, thin. Inflorescence of (3–)7–20 racemes diverging from a common axis 1–7 cm long, this seldom exceeding the longest raceme; racemes delicate, 3–13 cm long, the spikelets paired and overlapping by less than half their length on a narrowly winged triquetrous rhachis. Spikelets narrowly ovate-elliptic, 1.5–2.1 mm long, bluntly pointed; lower glume obscure or an ovate scale up to 0.2 mm long; upper glume two-thirds to four-fifths the length of the spikelet, 3-veined; lower lemma as long as the spikelet, 7-veined, the veins evenly spaced and smooth, obscurely appressed-pubescent, occasionally with a ciliate frill. Fruit elliptic in outline, mostly grey but varying from yellowish to purplish-brown.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on rocky hillsides and wadis, and deciduous woodland. *Altitude*: + 150 m. Distributed in Eastern Africa from Egypt southwards to South Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 211; Collenette, l.c., p. 371.

6. ***Digitaria ciliaris*** (Retz.) Koeler, Descr. Gram.: 27 (1802).
Synonyms. Panicum ciliare Retz. (1786); *Digitaria sanguinalis* auct. non (L.) Scop.: Schwartz (1939); Ghazanfar, Annot. Cat. Vasc. Pl. Oman: 133 (1992).

Description. Annual up to 100 cm high, decumbent at the base and geniculately ascending; leaf-blades broadly linear. Inflorescence of 2–12 digitate or subdigitate racemes, the axis up to 5 cm long in robust specimens; racemes stiff, 6–22 cm long, the spikelets paired and overlapping by two-thirds their length on a winged rhachis with triquetrous midrib. Spikelets narrowly elliptic, 2.5–3.3(–3.7) mm long, sharply acute; lower glume a distinct triangular scale usually 0.2–0.4 mm long; upper glume (half to) two-thirds to three-quarters the length of the spikelet, 3-veined; lower lemma as long as the spikelet, 7-veined, the veins smooth and evenly spaced or with a wide interspace flanking the midrib (sometimes the spikelets of a pair different), appressed-puberulous to silky-pubescent or rarely shortly villous, often with a ciliate frill, sometimes one or both spikelets of a pair with glossy bristles. Fruit elliptic in outline, grey to light brown.

Flowering and fruiting. February to April; September.

Distribution and habitat. Throughout Oman; in open grassland, and in deciduous woodland in Dhofar, and as a weed of cultivated and irrigated areas in Northern Oman and Wahiba Sands. *Altitude*: 50–1400 m. Throughout the tropics. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE Yemen; also found on Soqotra.

Distribution map & Illustration. 212; Collenette, l.c., p. 370.

62. **Pennisetum** Rich.
Eighty-four species; Africa, Asia to N Australia; Mexico to S tropical America, Cuba to S America.

1. Involucres persistent, usually stipitate, the bristles plumose or glabrous; lemmas usually pubescent on the margins; cultivated cereal ..... 1. **P. glaucum**
   Involucres deciduous; wild grass 2
2. Anther-tips penicillate; upper lemma subcoriaceous and glossy below 3
   Anthers-tips glabrous, or if thinly hairy or penicillate then upper lemma herbaceous throughout 4
3. Annual; involucral bristles scarcely exceeding the spikelets ..... 2. **P. sieberianum**
   Perennial; longest involucral bristles 10–40 mm long, much exceeding the spikelets ..... 3. **P. purpureum**
4. Bristles loosely plumose 5
   Bristles glabrous ..... 6. **P. divisum**
5. Densely tufted without rhizomes, the culms mostly unbranched; leaf-blades with conspicuously thickened midrib on the upper surface ..... 4. **P. setaceum**

Loosely tufted, sub-shrubby below, often with woody rhizomes, the culms woody and branched below; leaf-blades without thickened midrib ..... 5. **P. orientale**

1. ***Pennisetum glaucum*** (L.) R.Br., Prodr. [Fl. Nov. Holland]: 195 (1810).
Synonyms. Panicum glaucum L. (1753); *Holcus racemosus* Forssk. (1775) – Type: Yemen (specimen not located).

Description. Robust annual up to 3 m high (or even more); ligule a line of hairs; leaf-blades flat, up to (or exceeding) 100 × 7 cm. Panicle cylindrical, 10–50 cm long, dense; rhachis tomentose; involucres persistent, with a basal stipe 1–25 mm long, enclosing 1–9 spikelets; bristles glabrous or plumose, often shorter than the spikelets. Spikelets obovate, 3–6 mm long; lower glume obtuse or truncate, ± 0.6 mm long; upper glume similar but up to a third the length of the spikelet; lower floret male, the lemma as long as or almost as long as the spikelet, firmly membranous, truncate or shallowly emarginate, ciliolate at the tip and often pubescent on the margins below; upper lemma ovate, very obtuse, coriaceous, smooth and glossy on the back, densely pubescent on the margins; anther-tips penicillate. Fruit swollen, protruding from the spikelet.

Flowering and fruiting. April.

Distribution and habitat. Cultivated cereal (Bulrush millet), widely cultivated in the tropics for fodder and grain, particularly important in the Sahel zone of West Africa; cultivated in Oman. Elsewhere in the Arabian Peninsula recorded from Saudi Arabia, Yemen.

Distribution map & Illustration. 213; Collenette, l.c., p. 399.

2. ***Pennisetum sieberianum*** (Schltdl.) Stapf & C.E. Hubb. in Bull. Misc. Inform. 1933: 270 (1933).
Synonym. Penicillaria sieberiana Schltdl. (1853).

Description. Robust annual up to 120 cm high; ligule a line of hairs; leaf-blades broadly linear, flat. Panicle cylindrical, 5–15 cm long, dense; rhachis tomentose; involucres deciduous, with a basal stipe 0.2–1.5 mm long, enclosing 2 spikelets; bristles subglabrous to densely plumose, slightly exceeding the spikelets. Spikelets lanceolate to obovate, 4–6 mm long; lower glume absent or ovate to elliptic and up to 1 mm long; upper glume oblate, up to half the length of the spikelet; lower floret male or barren, the lemma slightly shorter than the spikelet, membranous, truncate, ciliolate towards the tip; upper lemma lanceolate to ovate, obtuse, subcoriaceous and glossy in the lower half, scabridulous to pilose near the margins above; anther-tips penicillate. Fruit somewhat swollen, enclosed within the spikelet or protruding from it.

Flowering and fruiting. February.

Distribution and habitat. Northern and Southern Oman, as a weed of cultivation. *Altitude:* 50–100 m. Ethiopia westwards through the Sahel to Senegal; Angola and Namibia. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, Yemen.

Distribution map & Illustration. 214; Collenette, l.c., p. 400.

Notes. A weed of cultivated or recently abandoned fields of *P. glaucum* that freely hybridizes with the cultivated plant.

3. ***Pennisetum purpureum*** Schumach., Beskr. Guin. Pl.: 44 (1827).

Description. Robust perennial often forming bamboo-like clumps; culms up to 6 m high; ligule a line of hairs; leaf-blades broadly linear, flat. Panicle cylindrical, 7–30 cm long; rhachis pubescent; involucres deciduous, enclosing 1–5 spikelets, one of them sessile and bisexual, the others shortly pedicelled and male (but similar in appearance); bristles glabrous or obscurely ciliate, the longest 10–40 mm long. Spikelets lanceolate, 4.5–7 mm long, glabrous; lower glume absent; upper glume a quarter to half the length of the spikelet, rarely absent; lower floret male or barren, the lemma two-thirds as long to as long as the spikelet, membranous, acuminate; upper lemma subcoriaceous and glossy in the lower half, acuminate; anther-tips penicillate.

Flowering and fruiting. March, April.

Distribution and habitat. Northern and Southern Oman, as weed of cultivation, occasionally planted for hedging. *Altitude*: 0–450 m. Tropical Africa; introduced in most tropical countries. Elsewhere in the Arabian Peninsula found in Saudi Arabia (record not confirmed).

Distribution map & Illustration. 215.

4. ***Pennisetum setaceum*** (Forssk.) Chiov. in Boll. Soc. Bot. Ital. 1923: 113 (1923).
Synonym. Phalaris setacea Forssk. (1775).

Description. Densely tufted perennial up to 130 cm high, the culms usually unbranched; ligule a line of hairs; leaf-blades inrolled with noticeably thickened midrib on the upper surface, rigid, harsh, glaucous. Panicle cylindrical, 6–30 cm long; rhachis with shallow angular ribs below the stumpless peduncle scars, glabrous to pilose; involucre enclosing 1 sessile and 0–1(–2) pedicelled spikelets, borne upon a slender pubescent stipe 1–3 mm long; bristles loosely plumose, the longest 16–40 mm long. Spikelets lanceolate, (4.5–)5–7 mm long; lower glume vestigial or up to 2 mm long; upper glume a fifth to two-thirds the length of the spikelet; lower floret male or barren, the lemma 1- to 5-veined, as long as the spikelet, acuminate; upper lemma similar to the lower; anther-tips glabrous.

Flowering and fruiting. February to April; September.

Distribution and habitat. Northern and Southern Oman; on the Hajar mountains and Dhofar mountains, on rocky hillside and in crevices of rocks. *Altitude*: ± 1400 m. North and northeast Africa and southwest Asia. Elsewhere in the Arabian Peninsula found in Qatar (introduced), Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 216; Collenette, l.c., p. 400.

5. ***Pennisetum orientale*** Rich. in Pers., Syn. Pl. 1: 72 (1805).

Description. Shortly rhizomatous perennial often forming large clumps; culms up to 2 m high, erect or ascending, woody and fastigiately branched below; ligule a line of hairs; leaf-blades flat or inrolled, without a noticeably thickened midrib. Panicle cylindrical, 8–30 cm long, often interrupted; rhachis with shallow angular ribs below the stumpless peduncle scars, scabridulous to pubescent; involucre enclosing 1 sessile and 2(–4) shortly pedicelled spikelets, borne upon a slender pubescent stipe 0.5–1.5 mm long; bristles, or at least the inner, loosely plumose, the longest 15–30 mm long. Spikelets lanceolate, 4.5–6.5 mm long; lower glume a quarter the length of the spikelet and obtuse, to one-third to two-fifths as long and acute, rarely as much as half as long and acuminate; upper glume half to three-quarters the length of the spikelet, acute to acuminate; lower floret male, the lemma as long as the spikelet, setaceously acuminate; upper lemma similar to the lower; anther-tips glabrous.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, in the Jebal Akhdar range, on steep rocky slopes. *Altitude*: ± 1700 m. North Africa eastwards to southwest and central Asia; India, Pakistan and Nepal. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration. 217; Collenette, l.c., p. 400.

Notes. Difficult to distinguish from *P. setaceum* except by habit.

6. ***Pennisetum divisum*** (J.F. Gmel.) Henrard in Blumea 3: 162 (1938).
Synonyms. Panicum divisum Forssk. ex. J.F.Gmel (1791); *Panicum dichotomum* Forssk. (1775), non L. (1753) – Type: Yemen, *Forsskal* (C); *Pennisetum dichotomum* Delile (1813), based on *Panicum dichotomum* Forssk.

Description. Perennial with short woody rhizomes; culms woody, branched throughout, up to 1(–2) m high; leaf-sheaths inflated, the lower readily shedding the short blade; ligule a line of hairs; leaf-blades tightly inrolled, pungent, glaucous. Panicle broadly cylindrical, 5–12 cm long; rhachis with shallow angular ribs below the cupular peduncle scars, scabridulous; involucre enclosing 1 sessile spikelet, borne upon a short oblong stipe 0.5–1 mm long; bristles glabrous, rarely thinly hairy, the longest 7–20 mm long. Spikelets narrowly lanceolate, 6.5–8.5 mm long; lower glume half to three-quarters the length of the spikelet; upper glume almost as long as the spikelet; lemma similar to the upper glume, the lower floret male; anther-tips glabrous.

Flowering and fruiting. February to April; September, October.

Distribution and habitat. Throughout Oman, in sandy deserts and wadis. *Altitude*: 50–650 m. North Africa, through southwest Asia to India. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 218; Collenette, l.c., p. 398.

63. **Cenchrus** L.

Twenty-six species; SE Europe, Africa to W Indo-China, N and E Australia to Pacific, America.

Cenchrus is distinguished from *Pennisetum* by its involucral bristles which are united at base.

1. Inner bristles rigid, flattened, connate for a quarter to two-thirds their length to form a cup ..... 3. **C. setigerus**
   Inner bristles flexuous, filiform above 2
2. Inner bristles united only at the base to form a disc 0.5–1.5 mm in diameter, occasionally connate for up to 0.5 mm above its rim; perennial ..... 1. **C. ciliaris**
   Inner bristles connate for 1–2.5 mm above the rim of the basal disc to form a cup; annual or short-lived perennial ..... 2. **C. pennisetiformis**

1. ***Cenchrus ciliaris*** L., Mant. Pl. 2: 302 (1771).

Synonym. Pennisetum cenchroides Rich. (1805), nom. superfl., based on *C. ciliaris* L.

Description. Perennial, often forming mats or tussocks; culms up to 150 cm high, ascending, wiry or somewhat woody. Panicle 2–14 cm long; involucre elongate, 6–16 mm long; inner bristles much exceeding the spikelets, one of them longer and stouter than the rest, united only at the base to form a disc 0.5–1.5 mm in diameter (or sometimes connate for up to 0.5 mm above the rim of the disc), sparsely to densely ciliate below, filiform above, flexuous, antrorsely scrabridulous; outer bristles filiform. Spikelets 1–4 per involucre, 2–5.5 mm long.

Flowering and fruiting. January to June; September.

Distribution and habitat. Throught Oman, in the foothills of the Hajar and Dhofar mountains, in wadis, in crevices and ledges, on sandy and silty soils and in irrigated farms. *Altitude*: 20–900 m. Throughout Africa, extending through southwest Asia to India; widely introduced elsewhere in the Old World. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 219; Collenette, l.c., p. 360.

2. ***Cenchrus pennisetiformis*** Hochst. & Steud. in Steud., Syn. Pl. Glumac. 1: 109 (1854).

Description. Annual or short-lived perennial; culms up to 40 cm high, ascending. Panicle 2–6 cm long; involucre elongate, 6–16 mm long; inner bristles much exceeding the spikelets, one of them longer and stouter than the rest, flattened at the base, connate for 1–2.5 mm above the rim of the basal disc to form a cup, almost glabrous to sparsely ciliate below, filiform above, flexuous, antrorsely scrabridulous; outer bristles filiform. Spikelets 1–3 per involucre, 3–5 mm long.

Flowering and fruiting. March to May; September.

Distribution and habitat. Northern and Southern Oman, in wadis, rocky hillsides in shade,

grassland, on damp sandy and silty soils, and in irrigated fields. *Altitude*: 20–1900 m. Eastern and northeastern tropical Africa to India; introduced in Australia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 220; Collenette, l.c., p. 361.

Notes. The boundary between *C. ciliaris* and *C. pennisetiformis* is very indistinct. *C. ciliaris* tends to be perennial with the involucral bristles united only into a disc, whereas *C. pennisetiformis* is more usually an annual and has a cupular involucre. There are, however, many intermediates.

3. ***Cenchrus setigerus*** Vahl, Enum. Pl. 2: 395 (1806).
Synonym. C. montanus Nees ex Steud. (1854) – Type: Saudi Arabia, *Schimper* 796, 797 (syntypes K).

Description. Perennial, forming clumps from a ± bulbous base; culms up to 80 cm high, geniculately ascending. Panicle 2–12 cm long; involucre cupuliform, 3–7 mm long; inner spines short, flattened, connate for a quarter to half their length, glabrous or obscurely puberulous; outer spines few, short, often suppressed, rarely almost as long as the inner. Spikelets 1–3 per involucre, 3–5 mm long.

Flowering and fruiting. January to April; September, October.

Distribution and habitat. Northern Oman and Southern Oman, in wadis, on sandy and stony ground, and in cultivated and waste ground. *Altitude*: 10–100 m. Eastern & northeastern tropical Africa eastwards to India; introduced elsewhere in the tropics. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 221; Collenette, l.c., p. 361.

Stenotaphrum secundatum (Walter) Kuntze, a cultivated lawn grass (Augustine grass) is reported from Saudi Arabia and UAE, where it has been grown as a lawn grass but escaped. It is not reported from Oman, but is expected to be found there as an escape. It is a stoloniferous perennial with broadly linear leaf-blades; ligule a line of hairs. Inflorescence 3–10 cm long, the racemes wholly or partially sunk in one face of a corky central axis, bearing 1–3 spikelets on a triquetrous rhachis prolonged into a naked subulate point; spikelets narrowly ovate, 4–5 mm long, pale green. Caryopsis lanceolate to oblong in outline.

Tribe XIV. ISACHNEAE Benth.

64. **Isachne** R.Br.
About 99 species; tropical and subtropical regions of the World.

Isachne globosa (Thunb.) Kuntze, Revis. Gen. Pl. 1: 778 (1891).
Synonym. Milium globosum Thunb. (1784).

Description. Aquatic perennial; culms erect, ascending or floating, up to 60 cm long. Ligule a line of hairs. Leaf-blades lanceolate, up to 13 × 2.5 cm. Panicle open or somewhat contracted. Spikelets all alike, 2-flowered without rhachilla extension, dorsally compressed, awnless, disarticulating below the florets and sometimes, tardily, between them; glumes tardily deciduous, membranous, shorter than or as long as the spikelet; florets similar or dissimilar, the lower bisexual (rarely male), the upper female or bisexual. Glumes subequal, almost as long to as long as the spikelet, 5- to 9-veined; lower glume broadly ovate, 1.5–2 mm long; upper glume similar but slightly shorter; lemmas dissimilar, the lower with a male flower, ovate, membranous, as long as the lower glume, the upper broadly elliptic, 1.2–1.8 mm long, coriaceous, shortly pubescent.

Flowering and fruiting. October.

Distribution and habitat. Southern Oman, Dhofar, in fresh and slightly brackish water pools, swamps and streams. *Altitude*: 150–950 m. India to south and southeast Asia and Australia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 222.

Tribe XV. ARUNDINELLEAE Stapf

1. Spikelets 1-flowered, falling entire at maturity ..... **66. Garnotia**
   Spikelets 2-flowered, breaking up at maturity 2
2. Ligule a very short membrane ..... **65. Arundinella**
   Ligule a line of hairs ..... **67. Loudetia**

65. **Arundinella** Raddi

Forty-nine species; tropical and subtropical regions of the World to temperate Asia.

Delicate annual; spikelets up to 2 mm long ..... 1. **A. pumila**
Tufted, rhizomatous perennial; spikelets 4–6 mm long ..... 2. **A. nepalensis**

1. ***Arundinella pumila*** (Hochst. ex A. Rich.) Steud., Syn. Pl. Glumac. 1: 114 (1854).
Synonym. Acratherum pumilum Hochst. ex A.Rich. (1850).

Description. Delicate annual up to 65 cm high, usually much less, stiff and erect or weak and decumbent; leaf-blades often thin and flaccid, narrowly elliptic, glabrous or with tubercle-based hairs. Panicle delicate, very effuse, 4–30 cm long. Spikelets mostly glabrous, sometimes thinly to densely hairy; lower glume elliptic, 1–1.5 mm long, acute; upper glume elliptic, 1.4–2 mm long, acuminate; lower lemma broadly elliptic, 1.3–1.6 mm long, acute; upper lemma elliptic, ± 1 mm long, obtuse and with a geniculate awn 2–3.5 mm long.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, on the south-facing escarpments, in forest shade or amongst taller grasses, and where there are ant nests, this is the only species

found there. *Altitude*: 300–900 m. Tropical Africa and tropical Asia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 223.

2. ***Arundinella nepalensis*** Trin., Gram. Panic.: 62 (1826).

Description. Tufted perennial with scaly rhizomes, up to 180 cm high; leaf-blades linear, flat or inrolled, stiff. Panicle oblong in outline, open or contracted, 10–40 cm long, the branches subsecund and densely spiculate. Lower glume ovate, 3–5 mm long, acuminate; upper glume narrowly ovate, 4–6 mm long, acuminate with an obtuse tip; lower lemma ovate, 3–4 mm long, obtuse; upper lemma ovate, 2–2.5 mm long, emarginate and with a geniculate awn 4–6 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on the escarpments hills, in forest shade. *Altitude*: ± 670 m. Tropical Africa eastwards through India to China and Australia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 224.

Notes. Collected only once in Arabia, in 1992, from the *Acacia-Commiphora* woodland in Dhofar. The collection was accidental and the specimen is incomplete. The determination, while most probably correct, must remain provisional until more complete specimens have been gathered. A return visit to the site in 1993 failed to rediscover the plant and it may already have succumbed to grazing by cattle.

66. **Garnotia** Brongn.

Thirty species; Aldabra to Seychelles, S Arabian Peninsula, tropical and subtropical Asia to Pacific.

Garnotia stricta Brongn. in Duperrey, Voy. Monde: 113, t. 21 (1832).

Description. Wiry, erect or procumbent short-lived perennial up to 60 cm high. Panicle loosely contracted. Spikelets 1-flowered, with a tuft of short hairs at the base; glumes subequal, 2.5–4.5 mm long, awnless or with an awn up to 4 mm long; lemma cartilaginous, a little shorter than the glumes, with a geniculate awn up to 14 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on rocky outcrops in forest shade. *Altitude*: 700–1000 m. India, through Southeast Asia to Australia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 225.

67. **Loudetia** Steud.

Twenty-five species; tropical and S Africa, Madagascar, Arabian Peninsula; Bolivia to Brazil and Paraguay.

Loudetia flavida (Stapf) C.E.Hubb. in Bull. Misc. Inform. 1934: 429 (1934).

Description. Tufted perennial up to 1 m high. Panicle open, bearing single or paired spikelets. Lower glume 4–7.5 mm long; upper glume 7.5 - 10 mm long; lower lemma 8.5 - 11 mm long; upper lemma, including the 0.5 mm obliquely pungent callus and 0.4 - 0.7 mm apical lobes, 4.8–5.3 mm long, 2- toothed at tip; awn very slender, flexuous, 30 - 35 mm long.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, on monsoon grassland and in rocky wadi beds. *Altitude*: 200–1000 m. Tropical and S Africa. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 226.

Tribe XVI. ANDROPOGONEAE Dumort.

1. Spikelets unisexual, with male and female in separate inflorescences, the male in an ample terminal panicle, the female in rows on a woody axillary cob ..... 92. **Zea**
   Spikelets, or at least one of each pair, bisexual 2
2. Spikelets not paired, unaccompanied by a vestige 3
   Spikelets paired, but sometimes one of them vestigial 5
3. Inflorescence a panicle ..... 71. **Cleistachne**
   Inflorescence of digitate or subdigitate racemes 4
4. Raceme rhachis tough ..... 80. **Dimeria**
   Raceme rhachis fragile ..... 84. **Arthraxon**
5. Rhachis internodes and pedicels slender, sometimes thickened upwards but then the upper lemma awned 6
   Rhachis internodes and pedicels stout, thickening upwards; upper lemmas awnless 23
6. Pedicelled spikelet similar to the sessile, both fertile 7
   Pedicelled spikelet differing from the sessile in shape and sex 8
7. Raceme rhachis fragile; one spikelet of the pair sessile ..... 68. **Saccharum**
   Raceme rhachis tough; both spikelets of a pair pedicelled ..... 69. **Imperata**
8. Inflorescence a panicle with elongated central axis; raceme internodes never with a translucent median line 9
   Inflorescence of single or subdigitate racemes, sometimes paniculate with an elongated central axis but then the raceme internodes with a translucent median line 10
9. Lower glume of sessile spikelet dorsally compressed ..... 70. **Sorghum**
   Lower glume of sessile spikelet laterally compressed ..... 72. **Chrysopogon**

10. Pedicels and internodes with a translucent median line (this often stained purple) ... 11
Pedicels and internodes without a translucent median line 13
11. Inflorescence a panicle; racemes with 1–2 sessile spikelets ..... 75. **Capillipedium**
Inflorescence of single or subdigitate racemes, rarely paniculate but then the racemes with 8 or more sessile spikelets 12
12. Racemes without homogamous pairs ..... 76. **Bothriochloa**
Racemes with homogamous pairs ..... 77. **Euclasta**
13. Lower floret of sessile spikelet male and with a palea 14
Lower floret of sessile spikelet barren and without a palea 15
14. Ligule a line of hairs ..... 79. **Sehima**
Ligule membranous ..... 78. **Apluda**
15. Upper lemma of sessile spikelet awned from low down on the back ... 84. **Arthraxon**
Upper lemma of sessile spikelet awned from the tip, or from the sinus of a bilobed tip 16
16. Lower glume of sessile spikelet 2-keeled; callus of sessile spikelet ± inserted in the hollowed tip of the internode 17
Lower glume of sessile spikelet convexly rounded without keels; callus of sessile spikelet applied obliquely to the internode with its tip free 19
17. Racemes solitary; lower glume of sessile spikelet convex ..... 83. **Schizachyrium**
Racemes paired or digitate, if single then lower glume of sessile spikelet shallowly or deeply depressed between the keels 18
18. Racemes not deflexed at maturity, borne upon unequal terete raceme-bases; leaves not aromatic ..... 81. **Andropogon**
Racemes usually deflexed at maturity, borne upon subequal flattened raceme-bases; leaves usually aromatic ..... 82. **Cymbopogon**
19. Upper lemma 2-toothed at the tip ..... 85. **Hyparrhenia**
Upper lemma entire 20
20. Raceme with 2 large homogamous pairs at the base forming an involucre ..... 87. **Themeda**
Raceme with or without homogamous pairs, if with then these not forming an involucre 21
21. Sessile spikelet subterete, the callus pungent ..... 86. **Heteropogon**
Sessile spikelet dorsally compressed, the callus obtuse 22
22. Spikelets wingless ..... 73. **Dichanthium**
Spikelets broadly winged ..... 74. **Pseudodichanthium**
23. Pedicel free from the adjacent internode 24
Pedicel fused to the adjacent internode 25
24. Callus applied obliquely to the top of the internode ..... 88. **Elionurus**
Callus applied transversely to the internode, reinforced by a central peg ..... 89. **Lasiurus**

25. Sessile spikelet globose ..... 91. **Hackelochloa**
Sessile spikelet not globose ..... 90. **Rottboellia**

68. **Saccharum** L.
Erianthus Michx.
About 35 species; Africa, Europe, temperate and tropical Asia, North America.

1. Upper lemma with awn well exserted from the glumes ..... 3. **S. ravennae**
Upper lemma with awn scarcely projecting beyond the tips of the glumes, or awnless 2
2. Glumes glabrous on the back, ciliate above, the upper conspicuously caudate-aristulate ..... 1. **S. kajkaiense**
Glumes pilose on the back, not caudate-aristulate ..... 2. **S. griffithii**

1. ***Saccharum kajkaiense*** (Melderis) Melderis in Fl. Iranica 70: 515 (1970).
Synonym. Erianthus kajkaiensis Melderis (1965).

Description. Tufted perennial up to 1.5 m high; ligule triangular; leaf-blades up to 4 mm wide, flat or inrolled, with thickened white midrib, glaucous. Panicle up to 20 cm long, the apex of the peduncle appressed silky-hairy; racemes 1.5–7.5 cm long, longer than the supporting branches. Spikelets 4.5–5.5(–7.5) mm long, the callus bearded with silky white hairs almost as long as the spikelet; glumes coriaceous below, glabrous on the back, ciliate above, the lower oblong-elliptic, acute or acuminate, the upper lanceolate, conspicuously caudate-aristulate; upper lemma acuminate, awnless.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, in the foothills of the Hajar mountains, in wadis with seasonal water. *Altitude*: 50–650 m. Iran, Afghanistan and Pakistan. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 227.

Notes. Material from Oman differs marginally from that from Iran and Afghanistan by its smaller spikelets (up to 5.5 mm rather than 6.5–7.5 mm). In this respect it more closely resembles material from Pakistan, but the latter is represented by only a single known collection. There is little doubt, however, that despite these differences there is only one taxon involved, the obvious unifying character being the caudate-aristulate upper glume.

2. ***Saccharum griffithii*** Munro ex Boiss., Fl. Orient. 5: 453 (1884).

Description. Tufted perennial up to 2 m high; leaf-blades markedly channelled or strongly inrolled, gradually reduced to a narrow wing on either side of the thickened midrib, glaucous. Panicle 20–35 cm long, the axis and peduncle glabrous; racemes 1.5–2.5 cm long, shorter than the supporting branches. Spikelets 4–5(–8) mm long, the callus bearded with dense cream or yellowish hairs scarcely as long as the spikelet; glumes membranous,

sparsely or densely hairy on the back; upper lemma with an awn up to 4 mm long and scarcely projecting beyond the tips of the glumes, rarely up to 10 mm long and conspicuously exserted.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, in the foothills of the Hajar mountains, in wadis, along water courses. *Altitude*: 400–600 m. Also Pakistan and Afghanistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 228; Collenette, l.c., p. 408.

Notes. The species is best recognized by its narrow panicles with cream or yellowish callus hairs shorter than the spikelet, and by the hairy glumes in both spikelets of a pair. Records from Saudi Arabia are all from cultivated material.

3. ***Saccharum ravennae*** (L.) Murray, Syst. Veg., ed. 13: 88 (1774).
Synonym. Andropogon ravennae L. (1763).

Description. Tufted perennial up to 4.5 m high; leaf-blades flat, up to 20 mm wide or narrower with thickened midrib. Panicle 25–70 cm long, dense or interrupted, the axis and peduncle glabrous; racemes 1.5–3 cm long, much shorter than the supporting branches. Spikelets slightly heteromorphous, 3–4 mm long, the callus bearded with whitish or greyish hairs scarcely as long as the spikelet; glumes membranous, those of the sessile spikelet glabrous, those of the pedicelled spikelet sparsely to moderately hairy on the back; upper lemmas with an awn 2.5–10 mm long and well exserted from the tips of the glumes.

Flowering and fruiting. January, March.

Distribution and habitat. Northern and Southern Oman, in shallow wadis, along water courses. *Altitude*: 50–500 m. Mediterranean region and the Sahara eastwards to northern India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 229; Collenette, l.c., p. 408.

69. **Imperata** Cirillo
Eleven species; tropical and subtropical regions of the World.

Imperata cylindrica (L.) Raeusch., Nomencl. Bot., ed. 3: 10 (1797).
Synonyms. Lagurus cylindricus L. (1759); *Arundo epigeios* Forssk. (1775) non L. (1753).

Description. Aggressively rhizomatous plant up to 120 cm high, forming tufts of leaves from the scaly rhizome; leaves basal, blades flat or loosely inrolled, stiffly erect. Panicle spike-like, cylindrical, 3–22 cm long, obscured by the copious silky white hairs. Spikelets 3–6 mm long.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman as a weed of cultivation. *Altitude*: 50–600 m.

Throughout the Old World tropics, extending to the Mediterranean region; also in South America. Doubtfully recorded from Oman from the Batinah, but it is very likey to be present there. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 230; Collenette, l.c., p. 387.

70. **Sorghum** Moench

About 29 species; Africa, temperate Asia; SE N America; introduced to Europe and N America.

1. Perennial with elongated rhizomes; wild ..... 1. **S. halepense**
   Annual or short-lived perennial without rhizomes; wild, cultivated or subspontaneous 2
2. Culm nodes glabrous or pubescent 3
   Culm nodes bearded; wild ..... 4. **S. deccanense**
3. Caryopsis large, commonly exposed by the gaping glumes; sessile spikelets persistent ..... 2. **S. bicolor**
   Caryopsis small, enclosed by the glumes; sessile spikelets persistent or tardily deciduous ..... 3. **S. ×drummondii**

1. ***Sorghum halepense*** (L.) Pers., Syn. Pl. 1: 101 (1805).

Synonym. Holcus halepensis L. (1753).

Description. Rhizomatous perennial up to 1.5 m high, slender to rather stout (rarely taller and robust), the nodes glabrous or pubescent. Panicle loose at anthesis, contracted afterwards, lanceolate to triangular in outline, 10–55 cm long; primary branches compound, bare at the base, ultimately bearing racemes of 1–5 spikelet pairs. Sessile spikelet elliptic to subelliptic, 4.5–5(–5.5) mm long, hairy at first, becoming glabrous; lower glume 7- to 9-veined (2–4 intercarinal veins visible near the tip), keeled above, the wings of the keels widening upwards to end in minute teeth, forming with the short apex a distinctly equally 3-toothed tip; upper lemma acute and minutely mucronate to 2-lobed and with an awn 10–16 mm long. Pedicelled spikelet male, 4.5–6.5 mm long.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, in date plantation, as a weed of cultivation. *Altitude*: 0–600 m. Mediterranean region eastwards to Pakistan and Kashmir (probably not native in India); cultivated for fodder (Johnson grass) in most warm countries, especially in North America. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration. 231; Collenette, l.c., p. 412.

Notes. Because of its tenacious rhizomatous habit the species has earned a bad reputation

as a weed of cultivated fields. Worse than this, under certain circumstances its tissues can develop hydrocyanic (Prussic) acid and the plant then becomes a positive danger to stock.

2. ***Sorghum bicolor*** (L.) Moench, Methodus: 207 (1794).
Synonym. Holcus bicolor L. (1771).

Description. Annual or short-lived perennial without rhizomes, up to 2.5 m high, often robust. Panicle very variable, lax to very dense, erect or with a curved peduncle, up to 25 cm long; primary branches compound, long or short, bearing stout compound racemes of 2–4 spikelet pairs. Sessile spikelet elliptic to obovate, 4–6 mm long, persistent; glumes subequal, pale yellow to chestnut brown or almost black; upper lemma with a weak awn up to 10 mm long; Caryopsis large, broadly obovoid or globular, exposed between the gaping glumes. Pedicelled spikelet lanceolate, barren, 3–4 mm long, persistent.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman; cultivated. Grown throughout the tropics, particularly in the Old World. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 232.

Notes. Cultivated cereal (sorghum, Guinea corn). An important cereal widely cultivated in Arabia.

3. ***Sorghum ×drummondii*** (Nees ex Steud.) Millsp. & Chase in Publ. Field Mus. Nat. Hist., Bot. Ser. 3: 21 (1903).
Synonym. Andropogon ×drummondii Nees ex Steud. (1854).

Description. Annual or short-lived perennial without rhizomes, up to 2 m high, often robust. Panicle somewhat contracted and moderately dense, up to 30 cm long; primary branches simple or compound, bearing racemes of up to 5 spikelet pairs. Sessile spikelet broadly lanceolate-oblong to elliptic-ovate, 6–7.5 mm long, persistent or tardily deciduous; lower glume 11- to 13-veined, 2-keeled, the wings of the keels ending in obscure teeth, forming with the short apex an indistinctly 3-toothed tip; upper lemma shortly 2-lobed at the tip and with an awn up to 12 mm long; Caryopsis slightly swollen. Pedicelled spikelet male or barren, up to 6 mm long.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, cultivated for fodder (Sudan grass). Cultivated in the Old World tropics and can occur spontaneously wherever the parents grow together. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, Yemen.

Distribution map & Illustration. 233; Collenette, l.c., p. 411.

4. ***Sorghum deccanense*** Stapf ex Bor, Grasses Burma Ceyl. Ind. Pak.: 245 (1960).
Synonym. S. versicolor auct. non Andersson.

Description. Annual up to 1.5 m high, the nodes densely bearded. Panicle narrowly oblong in outline, 10–20 cm long; primary branches whorled, simple, bearing 2–4 spikelet pairs. Sessile spikelet lanceolate, 5.5–8 mm long, bearded from the callus with pallid to rufous hairs; lower glume coriaceous, glossy, densely hairy on the back; upper lemma with an awn 20–40 mm long. Pedicelled spikelet linear to lanceolate, 5–7 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, on the Dhofar mountains, in monsoon grassland. *Altitude*: 100–900 m. India to Southeast Asia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 234.

Notes. The status of this species is at present unclear. Clayton (in Fl. Trop. E. Africa) amalgamated it with *S. purpureo-sericeum* because the two are apparently interfertile (Garber in Univ. Calif. Publ. Bot. 23: 317 (1950)). However, specimens from Oman, India and Southeast Asia are consistently different from those from tropical Africa, and there is a strong case for maintaining a distinction at species level.

71. **Cleistachne** Benth.

A single species; tropical and S Africa, Arabian Peninsula and India.

Cleistachne sorghoides Benth. in Hook., Icon. Pl. 14: t. 1379 (1882).

Description. Coarse annual up to 2.5 m high, often supported by stilt roots. Panicle linear to narrowly lanceolate in outline, 8–40 cm long; primary branches up to 4(–8) cm long; internodes and peduncles ('pedicels') hairy. Spikelets oblong-elliptic, 4–6 mm long; lower glume dark brown to black, pubescent with white or fulvous hairs; lower lemma fulvously pubescent at the tip; upper lemma with an awn 15–35 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, on the Dhofar mountains, in monsoon grassland. *Altitude*: ± 950 m. Distribution same as genus. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 235.

Notes. The spikelets are, in fact, sessile; what appears to be a pedicel is the peduncle of the raceme, the whole raceme having been reduced to a single spikelet. The true pedicelled spikelet and its pedicel are suppressed. The genus otherwise closely resembles *Sorghum*.

72. **Chrysopogon** Trin., nom. conserv.

Vetiveria Bory

Forty-eight species; tropical and subtropical regions of the Old World to the Pacific, SC and SE USA to Cuba.

1. Awns of the pedicelled spikelets plumose for ± their whole length .. 1. **C. plumulosus**
   Awns of the pedicelled spikelets glabrous or puberulous, or if plumose then only at the extreme base 2
2. Sessile spikelet 5–6 mm long ..... 2. **C. aucheri**
   Sessile spikelet 8–10 mm long ..... 3. **C. macleishii**

1. ***Chrysopogon plumulosus*** Hochst. in Jahresh. Vereins Vaterl. Naturk. Württemberg 3: 62 (1847) – Type: Saudi Arabia, *Schimper* s.n. (whereabouts uncertain), based on the same gathering as *Aristida chrysopila* Steud.
Synonyms. Aristida chrysopila Steud. (1840), *nom. nud.*; *A. aristidoides* Steud. (1854) – Type: Yemen, *Schimper* s.n. (P).

Description. Culms wiry, up to 90 cm high; leaves cauline or sometimes forming a compact basal cushion; basal leaf-sheaths laterally compressed or not; leaf-blades glaucous, glabrous to densely puberulous, with or without tubercle-based hairs. Panicle ovate in outline, 3–7 cm long. Sessile spikelet narrowly oblong, 4–6 mm long; upper glume with a plumose awn 7–15 mm long; upper lemma with a puberulous awn 20–30 mm long. Pedicelled spikelets 4–7 mm long, the lower glume and often also the upper bearing a plumose awn up to 15 mm long, this sometimes glabrous near the tip; pedicels a third to half the length of the sessile spikelet.

Flowering and fruiting. April, May; September, October

Distribution and habitat. Northern and Southern Oman, in the foothills of the Hajar and Dhofar mountains respectively, on rocky hillsides, and on stony plains, wadi beds and sandy hummocks. *Altitude*: 10–1800 m. Egypt, Sudan, Ethiopia, Somalia, Kenya and Tanzania. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 236; Collenette, l.c., p. 363.

2. ***Chrysopogon aucheri*** (Boiss.) Stapf in Bull. Misc. Inform. 1907: 211 (1907).
Synonym. Andropogon aucheri Boiss. (1844).

Description. Culms slender, up to 60(–100) cm high; basal leaf-sheaths often silky-villous; leaf-blades shortly and densely pubescent and with tubercle-based hairs on the margins, especially below. Panicle ovate in outline, 5–10 cm long. Sessile spikelet narrowly elliptic to narrowly oblong, 5–6 mm long; upper glume with a shortly pubescent awn 1.5–10 mm long; upper lemma with a shortly pubescent awn 25–40 mm long. Pedicelled spikelets (4–)7–10 mm long, the lower glume and often also the upper bearing a glabrous awn 4–7 mm long, this sometimes ciliate below, often absent; pedicels a third to half the length of the sessile spikelet.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, in the foothills of the Western Hajar mountains,

on stony hillsides. *Altitude*: 50–700 m. Iran, Afghanistan, Pakistan and northern India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 237.

3. ***Chrysopogon macleishii*** Cope in Kew Bull. 49: 533 (1994) - Type: Oman, Dhofar, above Dhalkut, *Cope* 514 (holo. K; iso. ON).

Description. Tall, loosely to densely tufted plant up to 1.5 m high; basal leaf-sheaths laterally compressed and sharply keeled, silky-villous when young; leaf-blades glabrous to shortly pubescent on the surface, scabrid on the margins and on the central vein beneath, with a few tubercle-based hairs on the margins below. Panicle oblong-ovate in outline, 13–20 cm long. Sessile spikelet narrowly lanceolate to narrowly oblong, 8–10 mm long; upper glume with an awn 9–12 mm long, this plumose in the lower fifth to a quarter, puberulous to glabrous above; upper lemma with a puberulous awn 35–45 mm long. Pedicelled spikelet 8–11 mm long, the lower glume bearing a glabrous to puberulous awn 10–14 mm long, the upper with a glabrous awn (1–)2–4 mm long; pedicels about half the length of the sessile spikelet.

Flowering and fruiting. October.

Distribution and habitat. Southern Oman, Dhofar, in *Commiphora* scrub on limestone pavement in monsoon grassland. *Altitude*: 500–1150 m. Endemic, not known elsewhere.

Distribution map & Illustration. 238.

Notes. Very similar to and obviously related to *C. orientalis* (Desv.) A. Camus from India and Southeast Asia. This species, however, has a much smaller sessile spikelet although the pedicel and pedicelled spikelets are much the same as in *C. macleishii*; the pedicel is therefore three-quarters to five-sixths the length of the sessile spikelet. It also has a more robust awn (up to 75 mm) on the upper lemma of the sessile spikelet, and a tendency towards a creeping base. In the Oman Plant Red Data Book: 2014, p. 227, it is assessed as Vulnerable (VU B1b(ii,iii)+2b(ii,iii)), for its localised populations that are under threat from development, agriculture and livestock farming.

73. **Dichanthium** Willemet

Eremopogon Stapf

Twenty species; tropical and subtropical regions of the Old World; introduced in North and South America.

1. Lower glume of sessile spikelet pitted; raceme solitary 2
   Lower glume of sessile spikelet not pitted; racemes solitary or subdigitate 3
2. Sessile and pedicelled spikelets about equal in size; callus hairs conspicuous, 2–2.5 mm long, at least half as long as the spikelet ..... 1. **D. foveolatum**
   Pedicelled spikelet longer and broader than the sessile; callus hairs inconspicuous, 0.3–0.5 mm long ..... 2. **D.micranthum**

3. Peduncle hairy; sessile spikelet elliptic to obovate ..... 3. **D. aristatum**
Peduncle glabrous; spikelet narrowly oblong ..... 4. **D. annulatum**

1. ***Dichanthium foveolatum*** (Delile) Roberty in Boissiera 9: 170 (1960).
Synonym. Andropogon foveolatus Delile (1813).

Description. Tufted perennial with silky-hairy basal leaf-sheaths and bearded nodes, the culms wiry, up to 80 cm high. Inflorescence of solitary racemes, each subtended by a narrow spatheole, these terminal and axillary and loosely aggregated; raceme 1.5–4.5 cm long, with 0–1 smaller homogamous pairs at the base. Sessile spikelet narrowly elliptic, 2.5–4 mm long; callus hairs conspicuous, 2–2.5 mm long; lower glume cartilaginous, glabrous, glossy, with a circular pit in the upper third, acute; upper lemmas with an awn 12–18 mm long. Pedicelled spikelet as long as the sessile, with or without a pit.

Flowering and fruiting. April to October.

Distribution and habitat. Throughout Oman, on sand and gravel, often overlying limestone, saline plains, rocky hillsides and as a weed of cultivation; common. *Altitude*: 0–1700 m. Mali and North Africa eastwards to India and Sri Lanka. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration. 239; Collenette, l.c., p. 369.

2. ***Dichanthium micranthum*** Cope in Publ. Cairo Univ. Herb. 7 & 8: 325 (1977) – Type: Oman, *Vesey-FitzGerald* 12316/1 (syntypes BM, K).

Description. Tufted annual or short-lived perennial with slender wiry culms up to 30 cm high, the nodes bearded. Inflorescence of solitary racemes, each subtended by a narrow spatheole, these terminal and axillary and loosely aggregated; raceme 1–3 cm long, without homogamous pairs at the base. Sessile spikelet narrowly elliptic, 2–2.5 mm long; callus hairs inconspicuous, 0.3–0.5 mm long; lower glume cartilaginous, glabrous except for the pectinate-ciliate margins near the tip, glossy, with a circular pit in the upper third, acute; upper lemma with an awn 16–22 mm long. Pedicelled spikelet longer and broader than the sessile, with a shallow circular depression or deep pit in the upper third.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, on the foothills of the Dhofar mountains, hillsides, in grassland, in sandy and gravelly plains and wadis. *Altitude*: 0–1200 m. Endemic; although found only in Dhofar, this species occurs in a wide range of habitats from sea-level to 1200 m and varies from obviously perennial to apparently annual.

Distribution map & Illustration. 240.

3. ***Dichanthium aristatum*** (Poir.) C.E. Hubb. in Bull. Misc. Inform. 1939: 654 (1939).
Synonym. Andropogon aristatus Poir. (1811).

Description. Tufted perennial with glabrous leaf-sheaths and shortly bearded nodes, up to

100 cm high. Inflorescence composed of 1–6 subdigitate, shortly pedunculate racemes, the peduncles and the culm below the inflorescence densely pubescent; racemes 2–8 cm long, the spikelets imbricate, with 1–6 smaller homogamous pairs at the base. Sessile spikelet elliptic to obovate, 2–5 mm long; lower glume firmly chartaceous, broadly convex, without a pit, pilose below the middle, glabrous above or shortly ciliate near the tip, broadly obtuse or with a subacute membranous tip; upper lemma with an awn 10–20 mm long. Pedicelled spikelet as long as the sessile, without a pit.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in open grassland on Jebal Qara. *Altitude*: 650–800 m. Tanzania eastwards through India to Southeast Asia; introduced throughout much of the rest of Africa and other tropical areas. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 241.

4. ***Dichanthium annulatum*** (Forssk.) Stapf in Prain, Fl. trop. Afr. 9: 178 (1917).
Synonym. Andropogon annulatus Forssk. (1775).

Description. Tufted perennial with conspicuously bearded nodes, up to 100 cm high. Inflorescence composed of (1–)2–15 subdigitate, shortly pedunculate racemes, the peduncles glabrous; racemes 3–7 cm long, the spikelets subimbricate, with 0–6 smaller homogamous pairs at the base. Sessile spikelet narrowly oblong, 2–6 mm long; lower glume firmly cartilaginous, without a pit, slightly concave, pubescent to villous below, with tubercle-based hairs on the margins above, obtuse to subacute; upper lemma with an awn 8–25 mm long. Pedicelled spikelet as long as the sessile, without a pit.

Distribution and habitat. Northern Oman and Southern Oman, on the Hajar and Dhofar mountains respectively, in monsoon grassland, a weed of cultivated and irrigated land, abandoned fields, roadsides and other disturbed places. *Altitude*: 250–1000 m. Senegal eastwards to India and Indonesia; introduced in southern Africa, tropical America and Australia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 242; Collenette, l.c., p. 369.

74. **Pseudodichanthium** Bor
A single species; temperate and tropical Asia.

Pseudodichanthium serrafalcoides (T. Cooke & Stapf) Bor in Indian Forester 66: 271 (1940).
Synonym. Andropogon serrafalcoides T. Cooke & Stapf (1908).

Description. Annual; ligule membranous. Culms slender, weak, branched, up to 90 cm high, the lower leaf-sheaths often loose. Inflorescences terminal and axillary, comprising a

single raceme subtended by a narrow spatheole, bearing imbricate spikelets and with 2–3 homogamous pairs at the base; internodes and pedicels solid with crateriform tip. Raceme 1.5–4 cm long, the slender peduncle often markedly falcate. Sessile spikelet elliptic-oblong, 6– 7 mm long, the upper lemma with an awn 30–35 mm long. Pedicelled spikelet elliptic, 9–10.5 mm long, obliquely winged, awnless.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in partial shade, on limestone escarpments. *Altitude*: 600–1100 m. Also India (Western Ghats). Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 243.

75. **Capillipedium** Stapf

Seventeen species; Eritrea to S Africa, tropical and subtropical Asia to W Pacific.

Cappillipedium parviflorum (R. Br.) Stapf in Prain, Fl. trop. Afr. 9: 169 (1917).
Synonym. Holcus parviflorus R.Br. (1810).

Description. Slender tufted perennial up to 150 cm high. Inflorescence a delicate panicle with elongated central axis and capillary branches and branchlets bearing short racemes of 1–5(–8) sessile spikelets and without homogamous pairs at the base, 8–25 cm long; racemes reduced to a triad of 1 sessile and 2 pedicelled spikelets, rarely with an additional sessile spikelet (and its pedicelled companion). Sessile spikelet dorsally compressed, narrowly oblong, 3–4 mm long, scabrid, occasionally pubescent, acute; lower glume shallowly concave, with 2 intercarinal veins; awn 10–15 mm long. Pedicelled spikelet lanceolate, 2.5–3.5 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on Jebal Qara in the monsoon grassland dominated by *Themeda*, usually growing up through and supported by shrubs. *Altitude*: 300–900 m. Eastern tropical Africa, tropical Asia and Australia. Not found esewhere in the Arabian Peninsula.

Distribution map & Illustration. 244.

Notes. The description properly refers to var. *parviflorum*. In Asia and Australia, the species shows more variation, much of it due to introgression from *Bothriochloa bladhii*, particularly with regard to number of spikelet pairs in the raceme. De Wet (in Amer. J. Bot. 54: 384–387 (1967)) analyzed the variation and recognized a total of four varieties.

76. **Bothriochloa** Kuntze

Thirty-six species; cosmopolitan.

The boundaries between *Bothriochloa*, *Capillipedium* and *Dichanthium* are not always clear. The problem results from the hybridization of one species, *B. bladhii*, not only with

other species of the genus, but with species of the other genera. The species and its nearest hybrid progeny, nearly all with the elongated central axis to the inflorescence, tend to be assigned to a single taxon (a 'compilospecies'), leaving all other taxa acceptably distinct. The uniting of all three genera, as a result of the behaviour of *B. bladhii*, is recommended by De Wet & Harlan (in Amer. J. Bot. 53: 94–98 (1966); in Taxon 19: 339–340 (1970); and in Evolution 24: 270–277 (1970)).

1. Inflorescence with an elongated central axis usually longer than the longest raceme .. .. 1. **B. bladhii**
   Inflorescence subdigitate or with the central axis shorter than the longest raceme ... 2
2. Lower glume of sessile spikelet pitted ..... 2. **B. insculpta**
   Lower glume of sessile spikelet not pitted ..... 3. **B. radicans**

1. ***Bothriochloa bladhii*** (Retz.) S.T. Blake in Proc. Roy. Soc. Queensland 80: 62 (1969).
Synonym. Andropogon bladhii Retz. (1781).

Description. Tufted perennial; culms up to 150 cm high, erect from a shortly rhizomatous base, often robust. Inflorescence with a central axis 4–8(–20) cm long, the racemes numerous and borne loosely or densely in irregular whorls upon simple or branched peduncles; racemes 2–5 cm long (the lowest shorter than the central axis), pubescent. Sessile spikelet narrowly elliptic, 3–4 mm long; lower glume ± hairy, usually not glossy, with or without a pit; awn 10–25 mm long. Pedicelled spikelet glabrous or thinly pubescent, with 0–3 pits.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on the mountains, in grassland. *Altitude*: 500–900 m. Old World tropics. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 245.

Notes. The rather short inflorescence axis characteristic of Arabian plants suggests that they are mostly introgression products from *Dichanthium annulatum* rather than pure *B. bladhii*.

2. ***Bothriochloa insculpta*** (Hochst. ex A. Rich.) A.Camus in Ann. Soc. Linn. Lyon, n.s. 76: 165 (1931).
Synonym. Andropogon insculptus Hochst. ex A. Rich. (1851).

Description. Tufted perennial; culms up to 200 cm high, often becoming decumbent and rambling or developing into stout woody stolons. Inflorescence subdigitate or with a central axis seldom over 3 cm long, bearing 3–20 shortly pedunculate racemes; racemes 2–8 cm long, pilose. Sessile spikelet narrowly elliptic, 3–4.5 mm long; lower glume firmly cartilaginous, glabrous or pilose below the middle, glossy, with a deep circular pit; awn 15–25 mm long. Pedicelled spikelet glabrous, with 0–4 pits.

Flowering and fruiting. July.

Distribution and habitat. Southern Oman, Dhofar, on Jebal Qamar, in grassland. *Altitude*:

± 650 m. Throughout Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 246.

Bothriochloa radicans (Lehm.) A.Camus (Ann. Soc. Linn. Lyon, n.s. 76: 164, 1931) may be found in Oman, but at pesent its presence in Oman is not confirmed; elsewhere in the Arabian Peninsula, it is found in Saudi Arabia.

77. **Euclasta** Franch.
Two species; tropical Africa to Myanmar; Mexico to S tropical America.

Euclasta clarkei (Hack.) Cope in Kew Bull. 35: 704 (1980).
Synonym. Indochloa clarkei (Hack.) Bor (1954).

Description. Slender rambling annual; culms wiry, up to 50 cm high, ligule membranous. Inflorescence of solitary racemes, the peduncles not or scarcely exserted from the supporting spatheole; racemes 2–2.5 cm long. Sessile spikelet dorsally compressed, broadly elliptic to ovate, 3.5–4 mm long; lower glume thinly cartilaginous, pilose below, narrowly winged on the keels above; awn (10–)15–25 mm long. Pedicelled spikelet glabrous, with many-veined lower glume, longer than the sessile.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on the mountains, in shaded locations. *Altitude*: 300–1100 m. Also India. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 247.

78. **Apluda** L.
A single species; Mascarenes, Socotra, Asia to W Pacific.

Apluda mutica L., Sp. Pl. 1: 82 (1753).
Synonym. A. aristata L. (1756).

Description. Rambling, short-lived perennial (often appearing annual); culms rooting at the lower nodes, up to 3 m long; ligule membranous. False panicle linear, interrupted, 3–40 cm long; spatheole narrowly ovate in profile, 3.5–10 mm long, acuminate. Sessile spikelet laterally compressed, 2–6 mm long; lower glume narrowly lanceolate-elliptic; upper lemma with an awn 4–12 mm long or awnless. Pedicelled spikelets awnless, broadly lanceolate, the larger 2–5 mm long, the smaller 1–2 mm long.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, on rocky hillsides and co-dominant with *Themeda* and *Sorghum* in grassland; common. *Altitude*: 50–850 m. Elsewhere in the Arabian Peninsula found on Socotra.

Distribution map & Illustration. 248.

79. **Sehima** Forssk.
Five species; Africa, temperate and tropical Asia and Australasia.

Sehima ischaemoides Forssk., Fl. Aegypt.-Arab.: 178 (1775) – Type: Yemen, *Forsskal* (whereabouts unknown).
Synonym. Andropogon sehima Steud. (1854), nom. superfl., based on *S. ischaemoides* Forssk.

Description. Annual up to 60 cm high. Raceme 3–15 cm long, gently curved; ligule a line of hairs. Sessile spikelet 9–15 mm long, laterally compressed; lower glume linear, firmly coriaceous with a deeply bifid membranous tip about as long as the body, 2-keeled above, the keels curving inwards towards the midline below, forming a deep slot between them and obscuring the intercarinal veins; upper lemma with an awn 4–7 cm long, the column ciliate along the edges of the coils. Pedicelled spikelet 7–15 mm long, ciliate, the lower glume with a midvein and 2–3 conspicuous lateral veins adjacent to each keel.

Flowering and fruiting. September, October.

Distribution and habitat. Southern Oman, Dhofar, on limestone pavement. *Altitude*: ± 1150 m in. Tropical Africa eastwards to Pakistan. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 249.

Notes. Known from Arabia from only three collections: Forsskal's type from Yemen, has been lost; the others are recent collections from Dhofar. The lack of extant material from Yemen has led to the suggestion that the species described by Forsskal must have been that which we know as *S. nervosum* (which is well documented in Yemen). However, Forsskal's reference to the lower glume of the sessile spikelet having an apex "biseta, inermis" would indicate more or less conclusively that this cannot, in fact, be the case. The species appears to be rare throughout its range and sporadic in its occurrence, and the recent discovery of it in Dhofar lends support to the belief that this was indeed the species described by Forsskal. It seems that *S. ischaemoides* may, subsequent to Forsskal's collection, have become extinct in Yemen.

In the Oman Plant Red Data Book: 2014, p. 229, it is assessed as Critically Endangered (CR D1) for its localised population, that may be easily be affected by disturbance to habitat.

80. **Dimeria** R. Br.
Sixty species; Madagascar, Arabian Peninsula; tropical and subtropical Asia, N & NE Australia to W Pacific.

Dimeria ornithopoda Trin., Fund. Agrost.: 167, t. 14 (1820).

Description. Annual up to 30 cm high, slender. Ligule a shortly ciliate membrane. Inflorescence of 2–3 subdigitate racemes; racemes 1.5–3.5 cm long, with flattened zig-zag, narrow-

ly winged rhachis, the spikelets borne singly, sessile in the angles and appressed to hollows in the raised midline. Spikelets 1.6–2.5 mm long, strongly laterally compressed, glabrous except for the minutely bearded callus; upper glume neither awned nor winged; upper lemmas with a glabrous awn 6–7.5 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on limestone hills, in grassland on. *Altitude*: 500–800 m. India, through Southeast Asia to Australia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 250.

Notes. A variable species in India, with a number of named varieties, and almost as variable in Arabia despite its limited range (the monsoon grasslands of Dhofar). Variation is mostly in spikelet size and scarcely worth documenting further.

81. **Andropogon** L.
About 104 species; cosmopolitan except Antartica.

Andropogon distachyos L., Sp. Pl. 2: 1046 (1753).

Description. Tufted perennial up to 100 cm high; basal leaf-sheaths silky-pubescent below; leaf-blades 7–20 cm × 1–5 mm, flat. Racemes paired, terminal, 4–14 cm long; internodes and pedicels stoutly linear to slightly clavate, ciliate. Sessile spikelet 8–16 mm long including the 1–2 mm callus; lower glume lanceolate, slightly convex to slightly concave on the back, herbaceous to thinly coriaceous, 7- to 11-veined between the keels, glabrous to pubescent; keels lateral, winged for half to two-thirds their length, the membranous wings confluent to a caudate, asymmetrically 2- toothed tip; upper glume with an awn 4–10 mm long; upper lemma bilobed to halfway, with an awn 15–30 mm long. Pedicelled spikelets 6–11 mm long; lower glume lanceolate, herbaceous, 2-toothed at the tip, with a slender bristle 3–9 mm long.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, on the Western Hajar mountains, in old abandoned field. *Altitude*: ± 850 m. Tropical Africa and South Africa, shores of the Mediterranean and in Thailand. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 251; Collenette, l.c., p. 344.

82. **Cymbopogon** Spreng.
Fifty-three species; tropical and subtropical regions of the Old World; introduced to North and South America.

1. Lowermost pedicel not swollen 2
   Lowermost pedicel swollen and barrel-shaped 3

2. Lower glume of sessile spikelet with sharply inflexed keels ..... 1. **C. jwarancusa**
   Lower glume of sessile spikelet with the keels rounded below ..... 2. **C. pospischilii**
3. Lower glume of sessile spikelet with sharply inflexed keels ..... 3. **C. schoenanthus**
   Lower glume of sessile spikelet with the keels rounded below ..... 4. **C. commutatus**

1. ***Cymbopogon jwarancusa*** (Jones) Schult. subsp. ***olivieri*** (Boiss.) Soenarko in Reinwardtia 9: 307 (1977).
Synonyms. Andropogon jwarancusa Jones (1798); *A. olivieri* Boiss. (1844); *Cymbopogon olivieri* (Boiss.) Bor (1963).

Description. Tufted perennial up to 60 cm high; basal leaf-sheaths scarcely coiled; ligule (1–)2–4 mm long; leaf-blades flat or inrolled, attenuate at the base. False panicle (7–)15–40 cm long; racemes 13–22 mm long, the lowermost pedicel neither swollen nor connate with the internode. Sessile spikelet lanceolate, 4.5–5.5 mm long; lower glume chartaceous, shallowly concave on the back, the keels sharply inflexed throughout; awn of upper lemma 7–10 mm long, with distinct column. Pedicelled spikelet ± 6 mm long.

Flowering and fruiting. May.

Distribution and habitat. Northern Oman, Musandam, on dry rocky hillsides and wadi beds. *Altitude*: up to 300 m. Iraq westwards to Pakistan and Northwest India. Elsewhere in the Arabian Peninsula found in Bahrain, UAE; also found on Soqotra.

Distribution map & Illustration. 252.

Notes. Subsp. *jwarancusa* is a taller plant (up to 150 cm) with coiled basal leaf-sheaths and a ligule less than 1 mm long.

2. ***Cymbopogon pospischilii*** (K.Schum.) C.E.Hubb. in Kew Bull. 4: 175 (1949).
Synonym. Andropogon pospischilii K.Schum. (1897).

Description. Tufted perennial up to 100 cm high; leaf-blades attenuate at the base. False panicle linear to narrowly oblong in outline, 10–30 cm long; racemes 15–35 mm long, the lowermost pedicel oblong but not swollen, free from the adjacent internode. Sessile spikelet narrowly lanceolate, 4.5–7 mm long; lower glume chartaceous, veinless or with 1–3 short veins near the tip, concave between the keels, these rounded in the lower half; awn of upper lemma 10–20 mm long, with distinct column. Pedicelled spikelet narrowly lanceolate, 4–7 mm long.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, on Jebal Akhdar range in the Western Hajar mountains, on rocky hillsides. *Altitude*: 1600–1950 m. Eastern Africa southwards to South Africa and eastwards to Pakistan and Nepal. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 253.

Notes. Material from Jebel Akhdar in Oman has slender, semi-terete leaf-blades, rather

different from the 1–4 mm wide blades (which may be flat or folded) characteristic of the species elsewhere in its range (including elsewhere in Oman). Whether this warrants formal recognition as a separate taxon is not yet clear.

3. ***Cymbopogon schoenanthus*** (L.) Spreng., Pl. Min. Cogn. Pug. 2: 14 (1815) subsp. ***schoenanthus***

Synonyms. Andropogon schoenanthus L. (1753); *A. circinnatus* Hochst. & Steud. (1854) Type: Saudi Arabia, *Schimper* 789 (K); *Cymbopogon circinnatus* (Hochst. & Steud.) Hochst. ex Hack. (1889).

Description. Tufted perennial up to 120 cm high; basal leaf-sheaths usually glabrous; leaf-blades attenuate at the base. False panicle narrowly oblong in outline, 5–40 cm long; racemes 20–30 mm long, woolly-villous with hairs 2–4 mm long, the lowermost pedicel swollen, its adjacent internode very short. Sessile spikelet narrowly lanceolate, 4–7 mm long; lower glume chartaceous, veinless and concave between the keels, these sharply inflexed throughout; awn of upper lemma 5–9 mm long, almost straight, scarcely differentiated into column and limb. Pedicelled spikelet narrowly lanceolate, 4–7 mm long.

Flowering and fruiting. April to October.

Distribution and habitat. Throughout Oman, on sandy and gravelly plains, wadi beds and rocky hillsides. *Altitude*: 0–1450 m. Africa north of the Sahara, Somalia and Djibouti. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 254; Collenette, l.c., p. 366.

4. ***Cymbopogon commutatus*** (Steud.) Stapf in Bull. Misc. Inform. 1907: 211 (1907).

Synonyms. Andropogon commutatus Steud. (1854); *Cymbopodon parkeri* Stapf (1929); *C. schoenanthus* subsp. *velutinus* Cope (1984) Type: Oman, *Radcliffe-Smith* 5586 (holo. K).

Description. Tufted perennial up to 150 cm high; basal leaf-sheaths usually pubescent to tomentose; leaf- blades attenuate at the base. False panicle linear to narrowly oblong in outline, 5–35 cm long; racemes 15–30 mm long, ciliate with hairs up to 2 mm long, the lowermost pedicel swollen, free from the adjacent internode which itself is sometimes swollen. Sessile spikelet narrowly lanceolate, 4–7 mm long; lower glume chartaceous, glabrous or pubescent, veinless or with 2–3 intercarinal veins in the upper third, deeply concave between the keels, these rounded in the lower half and often separated by a gibbous swelling at the base; awn of upper lemma 10–20 mm long, geniculate and with a distinct column. Pedicelled spikelet narrowly lanceolate, 4.5–7 mm long.

Flowering and fruiting. February to July.

Distribution and habitat. Northern Oman, on the Hajar Mountains and foothills, on exposed mountains slopes, in wadis, and on limestone and sandstone hills. *Altitude*: 50–1800 m. Tropical Africa eastwards to Iraq and India. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, Yemen.

Distribution map & Illustration. 255; Collenette, l.c., p. 365.

Notes. The distinction between *C. schoenanthus* and *C. commutatus* is not clear in Arabia. There may well be introgression from one species to the other in Arabia, and no single character will convincingly separate them. However, the following trends should be noted:

C. schoenanthus: keels of lower glume of sessile spikelet sharply inflexed throughout; glume flattish to shallowly concave with a basal swelling; awn indistinctly differentiated into column and limb; internodes and pedicels woolly-hairy all over; basal leaf-sheaths glabrous.

C. commutatus: keels of lower glume rounded below, often with a narrow interspace when glume flat; glume usually deeply concave with the keels ± dorsal, and without a basal swelling keeping them apart; awn clearly differentiated into column and limb; internodes and pedicels ciliate on the margins, glabrous or pubescent on the back; basal leaf-sheaths pubescent.

83. **Schizachyrium** Nees

Sixty-one species; Africa, temperate and tropical Asia, Australasia, Pacific, North and South America.

Schizachyrium brevifolium (Sw.) Büse in Miq., Pl. Jungh.: 359 (1854).
Synonym. Andropogon brevifolius Sw. (1788).

Description. Delicate annual; culms erect, creeping or scrambling, up to 60 cm long; leaf-blades narrowly oblong, obtuse; ligule membranous to scarious. Racemes 1–2.5 cm long, fragile, inconspicuous; internodes and pedicels linear to narrowly clavate, glabrous or hairy; spatheoles inrolled. Sessile spikelet dorsally compressed, narrowly lanceolate, 2–4 mm long; lower glume subcoriaceous, glabrous or rarely hairy, 2-keeled; upper lemma bifid almost to the base; awn 7–12 mm long, the column scarcely exserted, sometimes awnless. Pedicelled spikelet up to 1.5 mm long, with an awn up to 6 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in grassland, forming an understory below taller grasses. *Altitude*: 500–1100 m. Throughout the tropics. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 256.

84. **Arthraxon** P.Beauv.

Twenty-two species; tropical and subtropical region of the Old World to C Asia; introduced to South America.

1. Lower glume of sessile spikelet sharply inflexed along the margins, the keels pectinate-spinose; perennial ..... 1. **A. prionodes**
   Lower glume of sessile spikelet rounded on the margins, without keels; annual 2

2. Sessile spikelet 5–7 mm long, the lower glume usually muricate on the veins; racemes sometimes thinly hairy but usually silky-villous with hairs up to 3 mm long ..... 2. **A. cuspidatus**
Sessile spikelet rarely exceeding 5.5 mm, the lower glume scabrid or spinulose-hispid on the veins; racemes glabrous or shortly hairy 3
3. Pedicelled spikelets well developed, at least towards the tip of the raceme ..... 3. **A. lancifolius**
Pedicelled spikelets absent, pedicel reduced to a subulate stump 4
4. Stamens 3; racemes deflexed at maturity ..... 7. **A. nudus**
Stamens 2; racemes not deflexed at maturity 5
5. Rhachis internodes with short hairs; spikelets (2–)3–5.5 mm long ..... 4. **A. micans**
Rhachis internodes glabrous or thinly hairy, if with short hairs then spikelets not exceeding 1.5 mm 6
6. Spikelets 4–5.5 mm long ..... 5. **A. hispidus**
Spikelets 0.8–1.5 mm long ..... 6. **A. pusillus**

1. ***Arthraxon prionodes*** (Steud.) Dandy in Andrews, Fl. Pl. Sudan 3: 399 (1956).
Synonym. Andropogon prionodes Steud. (1854).

Description. Loosely tufted wiry perennial arising from a knotty base with silky-villous scales; culms straggling, up to 60 cm long. Racemes 2–8, each 4–8 cm long; internodes ciliate to pilose, the hairs increasing in length upwards to 2–3 mm. Sessile spikelet linear to narrowly lanceolate, 5–7 mm long; lower glume chartaceous, strongly convex, pectinate-spinose on the keels and often muricate on the back along the indistinct veins; anthers 3, 2.5–3.5 mm long; awn of upper lemma 8–15 mm long. Pedicelled spikelet narrowly lanceolate, 4–5.5 mm long, on a pedicel half as long as the internode.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on montane grassland and scrubby slopes. *Altitude*: 500–550 m. Eastern tropical Africa eastwards to India, China and Thailand. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 257; Collenette, l.c., p. 348.

Notes. Specimens from Dhofar have noticeably dense hairiness on the racemes, but are otherwise similar to plants from the rest of the Arabian Peninsula. The perennial habit of this species is seldom very obvious; the keeled lower glume is a supporting character if in doubt.

2. ***Arthraxon cuspidatus*** (Hochst. ex A. Rich.) Hochst. ex Hack. in DC., Monogr. Phan. 6: 353 (1889).
Synonym. Andropogon cuspidatus Hochst. ex A. Rich. (1850).

Description. Slender annual up to 60 cm high. Racemes 5–9, each 4–5 cm long; internodes thinly ciliate to villous, often densely so, the hairs increasing in length upwards to 2–3

mm. Sessile spikelet linear-lanceolate, 5–7 mm long; lower glume subcoriaceous, strongly convex, without keels, scabrid, usually muricate on the veins, becoming spinulose towards the tip; anthers 2, 0.7–1 mm long. Pedicelled spikelet vestigial or absent at the base of the raceme, up to 3.5 mm long towards the tip, the pedicel always present, a little shorter than the internode.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in grassland and forest, in shade. *Altitude*: 200–1000 m. Also Ethiopia and India. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 258.

3. ***Arthraxon lancifolius*** (Trin.) Hochst. in Flora 39: 188 (1856).
Synonyms. Andropogon lancifolius Trin. (1832); *Arthraxon lancifolius* var. *eremophilus* Bor (1971) Type: Oman, *Vesey-FitzGerald* 12318 3 (syntypes BM, K).

Description. Delicate trailing annual; culms slender, up to 30 cm long. Racemes 2–9, each 1–2 cm long; internodes ciliate, the silky hairs increasing in length upwards to 1–2(–3) mm. Sessile spikelet linear, 2–3.5 mm long; lower glume chartaceous, strongly convex, without keels, smooth and glossy below, scabridulous on the veins which become visible towards the clearly bidentate tip; upper glume extended into an awnlet 0.5–1.5(–4) mm long; anthers 2, 0.3–0.6 mm long; awn of upper lemma 5–15 mm long. Pedicelled spikelet lanceolate, 1.5–2 mm long, but often absent or present only at the tips of the racemes, the pedicel about half as long as the internode, rarely absent.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on grassy hillsides, in shaded locations, damp rocky banks and in crevices. *Altitude*: 350–850 m. Tropical Africa eastwards to China and Indonesia. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration. 259.

4. ***Arthraxon micans*** (Nees) Hochst. in Flora 39: 188 (1856).
Synonym. Andropogon micans (Nees) Steud. (1854).

Description. Slender annual; culms trailing, up to 50(–100) cm long. Racemes 2–12, each 2–4 cm long; internodes shortly ciliate with hairs 0.5(–1) mm long. Sessile spikelet lanceolate, (2–)3–5.5 mm long; lower glume chartaceous, strongly convex, without keels, granular below, becoming scabrid above, entire at the tip; upper glume acute or mucronate; anthers 2, 0.3–0.8 mm long; awn of upper lemma 7–10 mm long. Pedicelled spikelet absent, the pedicel reduced to an inconspicuous subulate stump up to 0.6 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on montane grassland. *Altitude*: 400

650 m. Tropical Africa eastwards to Thailand. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration. 260.

Notes. The pedicelled spikelet is almost entirely absent in *A. micans*, being represented only by a minute stump. Treated by some authorities synonymous to the following species, *A. hispidus*.

5. ***Arthraxon hispidus*** (Thunb.) Makino in Bot. Mag. (Tokyo) 26: 214 (1912).
Synonym. Phalaris hispida Thunb. (1784).

Description. Slender annual; culms ascending or trailing, up to 50 cm long. Racemes 4–9, each 3–5 cm long; internodes glabrous, rarely thinly and shortly hairy, but scarcely ciliate. Sessile spikelet lanceolate, (4–)4.5–5.5(–7) mm long; lower glume chartaceous, scrabridulous below, scabrid to spinulose-hispid on the veins above, strongly convex, without keels, entire at the tip; upper glume acute to mucronate; anthers 2, 0.6–1.2 mm long; awn of upper lemma 9–11 mm long. Pedicelled spikelet absent, the pedicel reduced to an inconspicuous subulate stump 0.5–2 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in grassland. *Altitude*: ± 600 m. India eastwards to China and Australia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 261.

6. ***Arthraxon pusillus*** Bor in J. Indian Bot. Soc. 50A: 92 (1971) – Type: Oman, *Vesey-FitzGerald* 12364/7 (syntypes BM, K).

Description. Exceedingly slender annual; culms ascending, up to 35 cm long. Racemes 2–9, each 0.5–3 cm long; internodes glabrous, rarely with hairy in the lower part. Sessile spikelet elliptic, 0.8–1.5 mm long; lower glume membranous, scrabridulous on the veins above, strongly convex, without keels, entire at the tip; upper glume subacute; anthers 2, ± 0.2 mm long; awn of upper lemma 5–6 mm long. Pedicelled spikelet absent, the pedicel reduced to a minute stump.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in grassland and forest. *Altitude*: 50–500 m. Endemic; known only from Dhofar.

Distribution map & Illustration. 262.

Notes. Very similar to the Indian *A. junnarensis* S.K. Jain & Hemadri with which it was amalgamated by van Welzen as a variety of *A. hispidus*. The discontinuity in spikelet length, as well as a difference in spikelet shape, is quite marked and clearly the uniting of *A. hispidus* and *A. pusillus* is inadvisable. The amalgamation of *A. pusillus* and *A. junnarensis* is reasonable given the phytogeographical connection between Dhofar and the latter's

locality in the Western Ghats, but *A. jumarensis* has spikelets twice the size of those of *A. pusillus* and anthers up to 0.5 mm long. Only the type of the Indian species is available for study, and for now the two species are maintained as distinct.

7. ***Arthraxon nudus*** (Nees ex Steud.) Hochst. in Flora 39: 188 (1856).
Synonym. Andropogon nudus Nees ex Steud. (1854).

Description. Annual; culms wiry, up to 60 cm long. Racemes 3–9, each 2–3.5 cm long, deflexed at maturity; internodes glabrous. Sessile spikelet linear-lanceolate, 3–4.5 mm long; lower glume chartaceous, smooth below, scabrid on the veins above, strongly concave, without keels, entire; upper glume acute; anthers 3, 0.5–1 mm long; awn of upper lemma 7–9 mm long. Pedicelled spikelet absent, pedicel reduced to a subulate stump, half as long as the sessile spikelet.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains, in forest and damp crevices in limestone cliffs. *Altitude*: 500–800 m. India to Southeast Asia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 263.

Notes. An easily recognized species by its deflexed mature racemes and 3 anthers.

85. **Hyparrhenia** E. Fourn.
About 56 species; tropical and subtropical regions of the World.

Hyparrhenia hirta (L.) Stapf in Prain, Fl. trop. Afr. 9: 315 (1918).
Synonym. Andropogon hirtus L. (1753).

Description. Tufted, shortly rhizomatous perennial up to 60(–100) cm high. False panicle typically scanty, up to 30 cm long; spatheoles linear-lanceolate, 3–8 cm long, reddish; peduncle about as long as the spatheole, with or without spreading white hairs above. Racemes never deflexed, 2–4 cm long, 8- to 13(–16)-awned per pair, villous with white hairs; raceme-bases unequal, the upper 2.5–5 mm long, filiform; homogamous pairs 1 at the base of the lower or both racemes. Sessile spikelet 4–6.5 mm long, villous; awn 10–35 mm long. Pedicelled spikelet 3–7 mm long, narrowly lanceolate, white-villous.

Flowering and fruiting. February to July.

Distribution and habitat. Northern and Southern Oman, including Musandam, on the mountains, rocky hillsides and mountain ledges, on dry sandy, gravelly and stony soils. *Altitude*: 10–1900 m. Mediterranean region eastwards to Pakistan and southwards to South Africa, but absent from much of tropical Africa. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 264; Collenette, l.c., p. 387.

86. **Heteropogon** Pers.
Five species; Europe, Africa, temperate and tropical Asia, Australasia, Pacific, North and South America.

Annual; pedicelled spikelet with a row of depressed glands along the middle of the lower glume ..... 1. **H. melanocarpus**
Perennial; pedicelled spikelet without glands ..... 2. **H. contortus**

1. ***Heteropogon melanocarpus*** (Elliott) Benth. in J. Linn. Soc., Bot. 19: 71 (1881).
Synonym. Andropogon melanocarpus Elliott (1816).

Description. Annual; culms robust, up to 2 m high, erect, supported by stilt-roots. Racemes 3–6 cm long, aggregated into a copious false panicle; homogamous pairs 1–3, resembling the pedicelled spikelets. Sessile spikelet 10–11 mm long, including the the sharply pungent, rufously bearded, 4 mm callus; lower glume elliptic-oblong, dark brown, densely hispidulous; awn 7–12 cm long. Pedicelled spikelet 15–25 mm long; lower glume light green, herbaceous, glabrous, with a median line of depressed glands running along its length, long-acuminate; callus 2–3 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in open, drier places on mountains. *Altitude*: 100–550 m. Tropical Africa and India; also in tropical America. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 265.

2. ***Heteropogon contortus*** (L.) P. Beauv. ex Roem. & Schult., Syst. Veg. 2: 836 (1817).
Synonyms. Andropogon contortus L. (1753); *Heteropogon hirtus* Pers. (1807), nom. superfl., based on *Andropogon contortus* L.

Description. Tufted perennial with laterally compressed basal leaf-sheaths; culms up to 1 m high, erect. Racemes 3–10 cm long, solitary or aggregated into a scanty false panicle, the awns twisted together to form a spire at the summit of the raceme; homogamous pairs 3–17, resembling the pedicelled spikelets. Sessile spikelet 5.5–10 mm long, including the ferociously pungent, rufously bearded, 2–3 mm callus; lower glume elliptic-oblong, brown, hispidulous; awn 5–8 cm long. Pedicelled spikelet 5–15 mm long; lower glume green with yellowish membranous margins, without glands, varying from glabrous to tuberculate-villous (mostly the latter in Arabia); callus 2–3 mm long.

Flowering and fruiting. April; October to December.

Distribution and habitat. Northern and Southern Oman, on mountains and slopes, and in grassland. *Altitude*: 150–2400 m. Tropical and warm temperate regions. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration. 266; Collenette, l.c., p. 386.

Notes. The species is characterized by the spire of twisted awns that develops at the top of the raceme, from which the needle-sharp callus of the sessile spikelet protrudes: the callus readily penetrates fur and clothing, often causing damaging sores, and is an efficient dispersal mechanism.

87. **Themeda** Forssk.

Twenty-seven species; Africa, temperate and tropical Asia, Australasia, Pacific, North and South America.

Themeda quadrivalvis (L.) Kuntze, Revis. Gen. Pl. 2: 794 (1891).

Synonyms. Anthistiria ciliata L. (1782); *Themeda triandra* auct. non Forssk.

Description. Annual up to 2 m high; culms slender to stout and often supported below by stilt-roots. Ligule very short, membranous. False panicle up to 55 cm long; spatheole 1.5–2.5 cm long, glabrous (the spathe often tuberculate-hairy). Raceme with 1 fertile spikelet; involucral spikelets narrowly elliptic, 5–6(6.5) mm long, tuberculate-hairy especially on the margins above. Sessile spikelet 5–6 mm long, including the blunt, rufously bearded, 0.5–1 mm callus; lower glume brown, appressedly hispid; awn 3.5–5.5 cm long. Pedicelled spikelet 5.5–7 mm long, glabrous; callus 1.5–2.5 mm long.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in grassland. *Altitude*: ± 500 m. India, Nepal and Myanmar. Elsewhere in the Arabian Peninsula found on Soqotra.

Distribution map & Illustration. 267.

88. **Elionurus** Kunth ex Willd.

Fifteen species; Africa to India, Papuasia to Australia, tropical and subtropical America.

Elionurus royleanus Nees ex A.Rich., Tent. Fl. Abyss. 2: 471 (1850).

Synonym. Andropogon elegantissimus Steud. var. *arabicus* Steud. (1854) – Type: Yemen, *Schimper* 831 (K).

Description. Annual up to 35 cm high, fastigiately branching. Ligule a short densely ciliate membrane. Racemes 2–6 cm long, embraced below by a reddish spathe, gathered into fascicles; internodes bearded towards the top. Sessile spikelet lanceolate; callus obconical, ± 1 mm long; lower glume broadly convex, with body 5–6 mm long, glabrous to villous on the back, with tufts of long hair arising from blunt teeth along the margins, divided above into 2 flattened tails 4–6 mm long. Pedicelled spikelet narrowly lanceolate, 6–20 mm long, caudate-acuminate to a subulate tip.

Flowering and fruiting. May; September.

Distribution and habitat. Northern and Southern Oman, on sandy, stony and rocky soils.

Altitude: 50–500 m. Mauritania to Northwest India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 268; Collenette, l.c., p. 375.

89. **Lasiurus** Boiss.
A single species; Sahara to NW India.

Lasiurus scindicus Henrard in Blumea 4: 514 (1941).
Synonyms. Saccharum hirsutum Forssk. (1775); *Triticum aegilopoides* Forssk. (1775), *nom. dub.* – Type not known; *Lasiurus hirsutus* (Vahl) Boiss. subsp. *arabicus* Chrtek (1968) – Type: Yemen, *Ibrahim* s.n. (CAI).

Description. Culms often woody below, up to 90 cm high, simple or branched, arising from a thick woody rhizome covered with firm, imbricate, often silky-hairy cataphylls. Ligule a line of hairs. Racemes up to 10 cm long, silky-villous from the internodes, pedicels and glumes. Sessile spikelet 6–13 mm long; lower glume lanceolate, often caudate, 2- toothed at the tip with divergent teeth, often spreading horizontally at maturity when dry. Pedicelled spikelet usually 5–7 mm long.

Flowering and fruiting. February to May; August, September.

Distribution and habitat. Throughout Oman, on sandy and gravelly desert soils, often amongst, and supported by, shrubs. *Altitude*: 10–1050 m. Mali to NE India. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 269; Collenette, l.c., p. 388.

90. **Rottboellia** L.f., nom. conserv., non Scop.
Six species; tropical and subtropical regions of the Old World.

Rottboellia cochinchinensis (Lour.) Clayton in Kew Bull. 35: 817 (1981).
Synonym. Stegosia cochinchinensis Lour. (1790).

Description. Annual; culms up to 3 m high, supported below by stilt-roots, the basal leaf-sheaths painfully hispid; leaf-blades up to 45 × 2 cm; ligule a very short membrane. Racemes cylindrical, fragile, 3–15 cm long, glabrous, terminating in a tail of reduced spikelets, gathered into a leafy false panicle. Sessile spikelet sunk in the internode, oblong-elliptic, pallid; lower glume 3.5–5 mm long. Pedicelled spikelet narrowly ovate, 3–5 mm long, herbaceous, green; pedicel oblong, flattened, shorter than the internode.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on mountains in the mist affected woodland. *Altitude*: 300–850 m. Distributed throughout the Old World tropics; introduced in the New World. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 270.

91. **Hackelochloa** Kuntze
Two species; tropical and subtropical regions of the Old World.

Hackelochloa granularis (L.) Kuntze, Revis. Gen. Pl. 2: 776 (1891).
Synonym. Cenchrus granularis L. (1771).

Description. Annual, culms up to 100 cm high; ligule a very short ciliate membrane; leaf-blades linear-lanceolate, coarsely hispid, subamplexicaul. Inflorescence of single racemes, these numerous and gathered into a leafy false panicle; racemes dorsally compressed; internodes flattened, oblong, cupuliform above, fused to the adjacent pedicel. Sessile spikelet globose; callus truncate, oblique, with a central boss; lower glume hemispherical, crustaceous, pitted and tuberculate, wingless; upper glume partly adherent to the enclosing internode; lower floret reduced to a hyaline lemma; upper lemma entire and awnless. Caryopsis oblate in outline, slightly dorsally flattened. Pedicelled spikelet 1.5–2.5 mm long, narrowly ovate, herbaceous, narrowly winged; pedicel broadly linear, scarcely distinguishable from the internode.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in the foothills of the escarpment mountains, and plains, in sandy and gravel soils. *Altitude*: ± 50 m. Distributed throughout the tropics. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration. 271.

92. **Zea** L.
Six species; Europe, Africa, temperate and tropical Asia, Australasia, Pacific, North and South America.

Zea mays L., Sp. Pl. 2: 971 (1753).

Description. Robust broad-leaved monoecious annual to 3(–5) m high. Leaf blades 50–90 × 3–12 cm. Female inflorescence axillary, a single raceme wrapped in several spathes; internodes fused into a polystichous woody cob bearing paired sessile spikelets at each node; racemes up to 30 cm long, with numerous spikelets in 8–16(–30) rows, not disarticulating at maturity; spikelets shallowly inserted in the surface of the cob, with short chaffy glumes exposing the Caryopsis; lower floret barren; style single, very long, silky, pendulous from the tip of the inflorescence. Male inflorescence terminal, 15–25 cm long, of digitate or paniculate racemes; internodes tough, narrow, bearing paired spikelets, one of them on a slender, free pedicel; both florets male.

Flowering and fruiting. February.

Distribution and habitat. Northern and Southern Oman; cultivated cereal (maize, corn). Originally from South America, cultivated throughout the tropics and subtropics, and in

warm temperate zones; often cultivated for fodder. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 272.

14. **Typhaceae**

Typha L.
About 30 species, largely distributed in the Northern Hemisphere, in wetland habitats.

Typha domingensis Pers., Syn. 2: 532 (1807).
Synonyms. Typha australis Schum. & Thonn. (1827); *T. angustata* Bory et Chaub. (1833); *Typha angustifolia* (non L.) Rech.f. (1964); *T. grossheimii* Pobed. (1949).

Description. Rhizomatous perennial, with a stout rhizome; stems erect, 1–3 m. Leaves distichous, overlapping the stem with broad sheathing bases, narrowing rather abruptly into the blade; blade linear, up to 40 × 0.4–0.8 mm, acute, flat above and convex beneath in dried material, glaucescent or green above, green beneath. Male and female inflorescences interrupted by 1–3 cm naked space. Male spike above the female, 17–34(–40) cm, ebracteate; bracteoles numerous, flattened, forked or laciniate above, ± as long as the stamens; male flowers with white filaments; anthers with the connective produced into a dark globose tip usually broader than the anther, paler when immature. Female spike 18–25 cm, reddish-brown at maturity; bracteoles spatulate, hyaline with a brownish tip; flowers parts subtended by numerous hairs 7–10 mm, with an acute tip ± equalling the bracteoles. Style and stigma linear, darker than the style, exceeding the flower. Fruit narrowly ovoid, acuminate, with purple streaks. Sterile flowers numerous, scattered irregularly throughout the spike, carpodium (gynoecium) clavate, purplish-streaked, tipped with a rudimentary style.

Flowering and fruiting. June to September.

Distribution and habitat. Throughout Oman, in wadis, foothills and plains, in swampy areas by permanent fresh and brackish water pools. *Altitude*: 100–600 m. Africa and SE Europe, Turkey, Cyprus, Syria, Lebanon, Jordan, Egypt eastwards to Arabia, Iraq, Iran and China. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 273.

15. **Pontederiaceae**

Eichhornia Kunth
Native to South America with six species widely naturalised in warm tropical and subtropical regions.

Eichhornia crassipes (Mart.) Solms, Monogr. Phan. 4: 527 (1883).
Synonym. Pontederia crassipes Mart. (1824).

Description. Aquatic and marshy perennial herb, to 50 cm, free floating (sometimes rooting) with long adventitious roots. Leaves floating, 40–110 × 50–100 mm, broadly ovate to rhomboid, entire, obtuse, base cuneate or rounded, glabrous; petiole sheathing at base, spongy, with a fusiform bulbous portion about the middle. Flowers pale purple tinged blue, in 6–15-flowered racemes. Perianth 6, united below into a tube; segments 30–40 mm, obovate to ovate-oblong, the posterior segment with a yellow spot. Stamens 6, unequal; anthers bluish purple. Ovary ovoid, glabrous; style 1, glandular; stigma 3-lobed, glandular. Fruit a 3-valved capsule.

Flowering and fruiting. March, April.

Distribution and habitat. Not commonly found in Oman, but has been introduced in a few water treatment tanks, for example in Al Lansab lagoons. *Altitude*: 50–300 m. Native of Brazil, introduced and naturalised in many tropical countries. Elsewhere in the Arabian Peninsula introduced in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 274.

16. **Liliaceae**

Bibliography

Stedje, B. (1987). A revision of the genus *Drimia* (Hyacinthaceae) in East Africa. Nordic Journal of Botany 7(6): 655–666.

In the APG IV (2016) classification, Liliaceae is split with several genera previously included in the Liliaceae (e.g. as in Cronquist 1981, followed here) treated under different families. Following APG IV classification, changes for the Oman Liliaceae would be: *Asphodelus* in the Asphodelaceae, *Asparagus*, *Chlorophytum*, *Dipcadi*, *Drimia* (= *Urginea*) and *Leopoldia* in the Asparagaceae, and *Pancratium* and *Crinum* (cultivated) in the Amaryllidaceae.

1. Leaves reduced to scales with sterile branches (cladodes) solitary or in fascicles; fruit a berry ..... 1. **Asparagus**
   Leaves well developed; fruit a capsule 2
2. Flower solitary, terminal; bract membranous, bifid at apex, enclosing the flower bud at base ..... 7. **Pancratium**
   Flowers more than one; bracts not enclosing bud at base 3
3. Perianth fused, tube oblong-urceolate, contracted above; lobes small ... 6. **Leopoldia**
   Perianth free or ± fused or fused at base only 4
4. Lower bracts spurred ..... 5. **Drimia**
   Lower bracts not spurred 5
5. Flowers nodding in racemes; stamens shorter than perianth, not exserted ... 4. **Dipcadi**
   Flowers not nodding in racemes; stamens exserted 6
6. Pedicels articulated; perianth white to pinkish with a reddish or dark red median stripe ..... 2. **Asphodelus**
   Pedicels not articulated; perianth white with a green midrib ..... 3. **Chlorophytum**

1. **Asparagus** L.

About 300 species distributed throughout Africa, parts of Europe, Asia and Australia.

1. Twiggy, pendant plant with dark green stems, becoming orange and fleshy with age, intricately branched, ridged, papillate to weakly spiny on ridges ..... 4. **Asparagus** sp. **A**
   Shrubby or climbing or scrambling plants; stems glabrous to puberulous, or ribbed, with week spines or spines absent 2
2. Large bushy shrub, without spines, not twining nor climbing; flowers solitary ..... 1. **A. capitatus** subsp. **gracilis**
   Erect, climbing or scrambling shrubs with spiny stems 3
3. Cladodes in fascicles of 5–25; flowers in axillary and terminal clusters of 2–10; bracts lanceolate ..... 2. **A. africanus**
   Cladodes in fascicles of 2–6; flowers in solitary or fascicled racemes, upper part of raceme with clusters of 3–6 flowers; bracts 1.5 mm, ovate, concave, glabrous, membranous ..... 3. **A. racemosus**

1. ***Asparagus capitatus*** subsp. ***gracilis*** Browicz in Fl. Iran. 165: 175 (1990).

Synonym. Asparagus gracilis Royle ex Baker (1875) nom. illegit.

Description. Large bushy shrub, without spines, not twining nor climbing; stems ascending to 2 m, weak, glabrous; lateral stems arising almost at right angles to the main stem. Cladodes in fascicles of 3–6, 6–16 mm, ± flexible, subulate. Bracts ± 2 mm, acute, glabrous, membranous. Flowers solitary; pedicels articulated below the middle. Perianth greenish to white, ± 3 mm, oblong to elliptic. Stamens shorter than the perianth. Ovary 3-locular. Berry ± 4 mm in diameter, 1-seeded.

Flowering and fruiting. March; June.

Distribution and habitat. Northern Oman, on the Western Hajar mountains in the Jebel Akhdar range, on the summit plateau and wadis, in pockets of sand amongst shrubs. *Altitude*: 1500–2000 m. Distributed from northern Oman to eastern Afghanistan and western Himalayas. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 275.

2. ***Asparagus africanus*** Lam., Encycl. Meth. Bot. 1: 295 (1783).

Description. Erect, climbing or scrambling shrub; stems to 4 m, glabrous to puberulous, ribbed, with spines 3–5 mm. Cladodes green, arcuate (in herbarium material), in fascicles of 5–25, ± flexible, subulate, 5–20 × 1–1.5 mm. Bracts lanceolate, caducous. Flowers in axillary and terminal clusters of 2–10; pedicels articulated below the middle, 3–8(–10) mm long. Perianth white to cream, ± equal, 3–4 mm, oblong. Stamens shorter than the perianth; anthers yellow. Ovary 3-locular; style with 3-branched stigma. Berry red, 5–6 mm in diameter, 1-seeded.

Flowering and fruiting. April.

Distribution and habitat. Northern and southern Oman, found on the Eastern Hajar mountains on Jebel Aswad, and on the mountains in Dhofar respectively, in crevices amongst boulders, in silty soil, climbing over shrubs. *Altitude*: 350–1200 m. Distributed from NE Africa to South Africa and from Arabia to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 276.

3. ***Asparagus racemosus*** Willd., Sp. Pl. 2: 152 (1799).

Description. Climbing or scrambling shrub; stems to 5 m, glabrous, ribbed, with curved spines 3–5 mm (to 2 cm on older stems). Cladodes in fascicles of 2–6, ± flexible, 8–25 mm, subulate, green, curving upwards (in herbarium material). Bracts 1.5 mm, ovate, concave, glabrous, membranous, sometimes falling quickly. Flowers in solitary or fascicled racemes, 15+ cm long, upper part of raceme with clusters of 3–6 flowers; pedicels articulated at or below the middle. Perianth greenish to white, 3.5–4 mm, oblong, obtuse. Stamens shorter than the perianth; anthers orange to reddish. Ovary 3-locular; style with 3-branched stigma. Berry red at maturity, 8–10 mm in diameter, 1(–2)-seeded.

Flowering and fruiting. July to October.

Distribution and habitat. Southern Oman, Dhofar, on the mountains, climbing and scrambling over shrubs, trees and fallen trees. *Altitude*: 5–500 m. Distributed from tropical Africa, through to India and Nepal; also found in Australia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 277.

4. ***Asparagus*** sp. ***A***

Description. Twiggy perennial herb, dark green, pendant. Stems up to 75 cm, becoming orange and fleshy with age (fide Miller 2571 on label), ascending, branched, intricate, ridged, papillate to weakly spiny on ridges, spines 1.5–2 mm. Leaves reduced to scales, brown, triangular with lacerate edges. Flowers up to 3 in axils of scale leaves. (Mature flowers not seen). Pedicel 3–3.5 mm, articulating below the middle. Berry globose, 4–5 mm in diameter, deflexed when mature, becoming papery when mature and rupturing irregularly. Seed globose, ± 3 mm, black, smooth and shiny.

Flowering and fruiting. October.

Distribution and habitat. Southern Oman, Dhofar, known from a single mature specimen, growing in a gravelly wadi bed (Ayun rd., 10 km W of turnoff from Salalah to Thumrait road, 700 m, 5 Oct. 1979, *Miller* 2571 (E ; K)). Very likely to be endemic to Dhofar.

Distribution map & Illustration. 278.

Notes. This taxon is clearly a new species coming closest to *A. stipularis* (which is dioecious), but lacking the rigid spine-tipped cladodes. More material is needed to establish this as a new taxon.

2. **Asphodelus** L.

A genus of 16 species, native to temperate Europe, the Mediterranean, Africa, the Middle East, and the Indian subcontinent, now naturalized in several countries including New Zealand, Australia, Mexico and southwestern United States.

Asphodelus fistulosus L., Sp. Pl., 309 (1753).

Vernacular names: buṣayli, mubṣayl (Arabic). English: Asphodel lily, onion-leaved asphodel, onion weed.

Description. Annual or short-lived perennial herb; stem erect, hollow up to 70 cm. Roots forming small tubers at base of stem. Leaves many arising from base of stem, cylindrical, hollow, up to 30 cm. Inflorescence a panicle with widely spaced flowers. Pedicel articulated. Perianth 6, white with a dark red median stripe, ovate. Stamens 6; filaments white; anthers orange. Ovary 1-locular; style white; stigma 3-lobed. Fruit a capsule, ± 3 mm in diameter, brown, opening by 3 valves. Seeds many.

Flowering and fruiting. December to May, after winter rain in northern Oman; September to December in southern Oman.

Distribution and habitat. Throughout Oman, in gravelly and sandy places, wadi banks, open *Acacia* woodlands, edges of fields and irrigated areas and along roadsides; a common spring annual. *Altitude*: sea-level–1600 m. Distributed in the Mediterranean region, Morocco to Caucasus, Arabia, Canary Islands, Madeira, Azores, Mauritius; naturalized in New Zealand, Mexico, southwestern United States. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 279.

Notes. Oman material identified as *A. aestivus* Brot. (distribution Spain, Portugal), *A. tenuifolius* Cav. and *A. fistulosus* var. *tenuifolius* are referable to *A. fistulosus*.

3. **Chlorophytum** Ker-Gawl.

About 150 species, mainly in tropical Africa.

Chlorophytum laxum R.Br., Prodr. Fl. Nov. Holl.: 277 (1810).

Synonym. Chlorophytum laxiflorum Baker (1876).

Vernacular names: zuxezux (Jibbalī); esxalotteh, ta'ta' (Ẓufari Arabic).

Description. Perennial herb to 10 cm. Roots tuberous; tubers cylindrical, 20–40 mm. Leaves several, all basal, glaucous, 5–15 cm, linear, lamina folded along its length, glabrous. Fibrous remains of old leaves at base. Flowers in simple or little branched racemes; flowers 5–20, arranged laxly. Perianth segments free, in two whorls, white with a green

midrib, ± 4 mm, oblong, acute, green-tipped; inner segments narrower than the outer ones. Stamens 6, included. Ovary 3-locular; style filiform; stigma capitate. Capsule 4–5 mm, deeply 3-lobed, many-seeded. Seeds black, shiny.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in the dry plains and plateaux, amongst stones. *Altitude*: ± 450 m. Distributed in NE tropical Africa (Chad, Ethiopia) and from India to western Malesia and northern Australia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 280.

Notes. The tubers and leaves are edible.

4. **Dipcadi** Medikus

About 55 species distributed in the southern Mediterranean, Africa, Arabia, Socotra, Madagascar and India with the greatest diversity in South Africa.

1. Scape 2 (rarely 3)-flowered ..... 3. **D. biflorum**
   Scape with more than 3 flowers 2
2. Perianth segments unequal, the outer segments caudate ..... 1. **D. viride**
   Perianth segments equal, outer segments not caudate ..... 2. **D. serotinum**

1. ***Dipcadi viride*** (L.) Moench, Suppl. Meth. 267 (1802).
Synonym. Hyacinthus viridis L. (1759).

Description. Bulbous perennial, 10–50 cm, glabrous. Bulb globose or ovoid, ±3 cm in diameter, covered with a tunic of white scales. Leaves several (to 15), all basal, to 55 × 1.5 cm, linear to linear-lanceolate, erect to spreading, margins entire to ± undulate. Scape single, bearing 5–30 flowers. Bracts 5–14 mm, triangular, acute or acuminate. Pedicels to 6 mm enlarging in fruit. Perianth tubular with six segments, the outer and inner unequal, yellowish green to brown; perianth segments 8–12 mm; inner elliptic, the outer oblong-lanceolate, caudate, spreading. Stamens included; style single. Capsule loculicidal, trigonous, 14 × 13 mm. Seeds ± circular, black, flattened.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on escarpment mountains in woodland dominated by *Anogeissus dhofarica* and *Ficus vasta*, amongst area of large boulders in pockets of soil, and in area of open dissected plateau at boundry of Jebal Qara and Jebal Semhan, with inland draining wadis, with *Euphobia balsamifera* and *Dracaena serrulata*. *Altitude*: 950–1000 m. Distributed throughout tropical and southern Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 281.

Notes. D. viride is common in southern Arabia (Dhofar, Yemen and SW Saudi Arabia), where it is fairly uniform in morphological characters. Elsewhere in Africa it is recorded to be morphologically variable.

2. ***Dipcadi serotinum*** (L.) Medik., Hist. & Commentat. Acad. Elect. Sci. Theod.-Palat. 6: 431 (1790).
Synonym. Hyacinthus serotinus L. (1753).

Description. Bulbous perennial, to 25 cm, glabrous. Bulb globose or ovoid, ± 3 cm in diameter, covered with a tunic of white scales. Leaves 2–6, as long as the scape, linear to linear-lanceolate, erect to spreading. Scape single, bearing 10–20 flowers in a one-sided raceme. Bracts as long as the pedicels, membranous. Pedicels to 2–5 mm. Perianth greenish brown, to 12 mm; perianth segments equal, ± 4 mm, oblong, obtuse. Stamens included. Ovary stipitate; style single. Capsule loculicidal, trigonous, ± 10 mm.

Flowering and fruiting. April, May.

Distribution and habitat. Northern Oman, in the Hajar mountains and foothills, in sandy soil amongst stones, and in dry sandy areas, amongst stones. *Altitude*: 50–1500 m. Distributed from Egypt through the Arabian Peninsula, Iraq, Iran, Pakistan to India. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE.

Distribution map & Illustration. 282.

Notes. D. serotinum is a widespread and common species which occurs throughout the Arabian Peninsula from 50 – 1500 m. The perianth is variable in colour from greenish yellow or white tinged with pink to brownish red. In the Arabian Peninsula plants growing in dry sandy areas at lower altitudes tend to be smaller in size with a shorter scape and shorter perianth segments. Specimens with short, brown perianth segments have been identified as *D. erythraeum* Webb & Berthel. (= *D. unicolor* (Stocks) Baker) but this distinction is not constant and does not justify an independent taxonomic status.

3. ***Dipcadi biflorum*** Ghaz., Kew Bull., 51(4): 803-807 (1996) – Type: Oman, Masirah Island, *Bryan* s.n. (holo. K; iso. ON, SQUH).
Vernacular names: shkhāl (Arabic); hambaseel, umbaseel (Arabic in the the Eastern Hajar area); shekalet (Harsūsī).

Description. Short-lived bulbous perennial, glabrous. Bulb globose or ovoid, 1.8–2 cm in diameter (situated up to 6 cm below ground), covered with a tunic of white scales. Leaves 2–3, all basal, (5–)10–16 × 0.7–1 cm, linear to linear-lanceolate, somewhat fleshy, arising 2–3 cm above the ground, twisting once, erect to spreading and touching the ground. Scape single (rarely more), 8–9 cm, bearing 2 flowers (rarely more). Floral bracts 2, scarious, 5–7 mm, triangular, acute or acuminate, enlarging in fruit. Perianth tubular with six segments, the outer and inner equal, whitish yellow to yellowish green with a dark green median stripe; perianth segments 6.5–7 × 2 mm, oblong, obtuse but with a small acute tip, erect. Flowers hermaphrodite, with six included stamens; style single with a rounded

stigma placed below the anthers. Capsule loculicidal, trigonous, 14–15 × 9–10 mm. Seeds circular, black, flattened.

Flowering and fruiting. March to May, after heavy rain; capsule takes about 3 weeks to mature.

Distribution and habitat. Central Oman, in the central limestone desert, Masirah Island, foothills and the coastal rocky areas of the eastern Hajar mountains, in sandy soil, and sandy pockets amongst rocks. A regional endemic, fairly widespread in Oman, but never common. *Altitude*: sea-level–500 m. Elsewhere in the Arabian Peninsula found in the UAE.

Distribution map & Illustration. 283.

Notes. A small insignificant plant very easy to miss, especially when growing amongst stones. The flowers are self-pollinated and have no perceptible fragrance. The bulbs are edible and are favoured by the local Harsūsī in central Oman. Chromosome number 2n= 12.

5. **Drimia** Jacq. ex Willd.

A genus with about 10 species distributed in southern and tropical Africa.

Drimia sp. ***A***

Vernacular names: ḥeysir, ḥubsir (Jibbalī).

Description. Bulbous perennial, 15–30 cm, glabrous. Bulb 2 cm across, with tuberous roots. Leaves few, to 15 cm, linear, lamina folded along its length, green with dark green transverse stripes especially prominent in the lower part. Inflorescence a lax raceme of few flowers (5 flowers in specimens seen). Bracts 2 mm, linear; spur 2 mm. Pedicel 10–14 mm. Perianth, pale green with 2 dark green median veins, 9–10 mm, free almost to base, lobes oblong. Capsule (immature) 2–3 mm.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in wadis, amongst rocks and stones. *Altitude*: 5–250 m. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 284; Miller & Morris, Pl. of Dhofar 1988: 187 fig. 3A–D.

Notes. Known from a few collections from Dhofar, the plant is easily distinguished by its striped leaves. In the Oman Plant Red Data Book: 2014, p. 190, it is assessed as Vulnerable (VU B2b(ii,iii)), for its small populations that may be easily be affected by disturbance to habitat.

6. **Leopoldia** Parl. *nom. conserv.*

About 25 species in the Mediterranean region, SW Asia and the Caucasus.

Leopoldia longipes (Boiss.) Losinsk., V.L. Komarov (ed.), Fl. URSS 4: 410 (1935) incl. *L. longipes* subsp. *negevensis* Feinbrun & Danin (1986).

Synonyms. Muscari longipes Boiss. (1854); *Bellevalia longipes* (Boiss.) Bornm. (1939) nom. illeg.

Description. Bulbous perennial to 40 cm, with an ovoid bulb. Leaves green, 3–5, erect to spreading, 15–30 × 1–1.5 cm, linear-lanceolate to falcate, glabrous, margins smooth or scabrid. Scape about as long as or exceeding the leaves. Flowers in a terminal conical raceme, 6–10 cm, becoming lax in fruit. Pedicels 5–15 mm, patent to ascending, longest in fruit. Sterile flowers few, short pedicellate, purple. Fertile flowers purplish blue in bud turning greenish purple or greenish yellow when mature with pale purple lobes; perianth 5–7 mm, oblong-urceolate, contracted above; lobes small. Stamens 6, attached to perianth tube. Capsule 9–10 mm, almost elliptic, emarginate to apiculate, persistent. Seeds black.

Flowering and fruiting. March.

Distribution and habitat. Northern Oman, only known from Musandam, in the mountains, in sandy and gravelly locations, in disturbed fields and along roadside; not common and recorded only twice from Wadi Sih, above Kasab. *Altitude*: 150–1350 m. Widely distributed from Egypt, Syria, Lebanon, Palestine, Jordan to Iraq, Iran, and southern Turkey. Elsewhere in the Arabian Peninsula found in the UAE.

Distribution map & Illustration. 285.

7. **Pancratium**

About 16 species distributed from the Canary Islands, the Mediterranean, throughout Africa to tropical Asia.

Pancratium maximum Forssk., Fl. Aegypt.-Arab. 72 (1775).

Vernacular names: ḥusay al-ḥemār; zebīb al-ḥemār (Dhofārī Arabic); agereyz esuxer, ēdaḥ esebero' (Jibbālī).

Description. Bulbous perennial to 30 cm. Bulb globose, 4–6 cm in diameter covered with several layers of reddish brown membranous tunics. Leaves 2–7, 10–30 × 2.5–18 cm, linear-elliptic to narrow elliptic, apex acute, margins entire, base abruptly narrowing into the petiole, glabrous. Flower solitary, terminal on a 7–10 cm long peduncle. Bract membranous, bifid at apex, enclosing the flower bud at base. Perianth with a long cylindrical tube 11–16 cm, green, divided above into 6 segments; segments white, 8–10 cm, narrowly elliptic, spreading. Stamens 6, inserted at throat of perianth tube; stamens fused below to form a cup 4–5 cm, free above to 2 cm, with 2 short triangular lobes between each stamen; anthers pale yellow. Ovary 3-locular; style slender; stigma capitate. Seeds many, angular, black.

Flowering and fruiting. August.

Distribution and habitat. Southern Oman, Dhofar, on the south face of the escarpment mountains, plateau and coastal plains. *Altitude*: 150–900 m. Distributed in Sudan and SW Arabia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 286.

Notes. The bulbs and leaves are toxic to livestock. In the Oman Plant Red Data Book: 2014, p. 191, it is assessed as Vulnerable (VU C1), for its small populations that are under threat from increasing abandonment of terraced field and habitat disturbance.

Cultivated species

Crinum zeylanicum (L.) L., Syst. Nat. ed. 12, 2: 236 (1767).
Bulbous geophyte with bulbs up to 10 cm in diameter. Leaves 30 cm or more, with wavy margins. Flowers sessile, in umbels; perianth white with pink to purplish median region, with a long tube and oblong-elliptic lobes. Native of tropical Asia, introduced to several warm regions including Oman where it is grown in villages in the foothills of the Hajar mountains in date-palm orchards. Fl. March, April.

17. **Iridaceae**

Bibliography

Goldblatt, P. & Manning, J.C. (2008). The Iris family: natural history & classification. Timber Press.

Flowers zygomorphic, in a spike on well developed stem; flowers with slender style, not petaloid; capsule obovoid, without a long beak ..... 1. **Gladiolus**
Flowers actinomorphic, solitary or 2 on a short stem; flowers with stylar branches petaloid; capsule cylindrical to ellipsoid, with a persistent 2 cm long beak ..... 2. **Moraea**

1. **Gladiolus** L.

About 180 species in Africa (with a concentration in SW Cape), W & C Europe, the Mediterranean region, SW & C Asia; Atlantic Islands.

Flower spike 6–10-flowered; perianth pink to pale purple, 4–5 cm, including the short tube ..... 1. **G. italicus**
Flower spike 3–4-flowered; perianth white, 9–13 cm, including the long 7–10 cm tube ..... 2. **G. candidus**

1. ***Gladiolus italicus*** Miller, Gard. Dict. ed. 8, no. 2 (1768).
Synonym. Gladiolus segetum Ker-Gawl. (1804).
Vernacular names: sād, māsh (Arabic).

Description. Geophyte to 1 m, with an ovoid corm about 1–2 cm in diameter covered with brown fibrous tunics. Leaves 4(–5), with the lowest broadest; leaves 15–30 × 0.5–1.5 cm, lanceolate, the lowest short acuminate, margins entire, glabrous, erect to spreading. Scape single with 6–10 flowers in the spike. Bracts and bracteoles leaf-like, 3–8 cm, subtending the flowers; bracteoles smaller than bracts. Perianth pink to pale-purple, 4–5 cm; tube straight or slightly curved; perianth segments with the upper median longer, the lower 3 × equal, elliptic. Stamens 3, inserted in throat of perianth. Ovary 3-locular; style exserted; stigma 3-lobed. Capsule 1–1.5 cm, obovoid. Seeds brown, globose, without wings.

Flowering and fruiting. February to April.

Distribution and habitat. Northern Oman, on the western Hajar mountains, and Musandam, in silty and sandy places in irrigated fields, and abandoned cultivations. *Altitude*: 1300–1500 m. Distributed from N Africa through the Arabian Peninsula, Caucasus, Cyprus, eastwards to Turkey and Europe, westwards to Syria, Palestine, Iraq and Iran; introduced in western USA. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 287.

Notes. A weed of cultivated fields, not recorded from natural habitats. In the Oman Plant Red Data Book: 2014, p. 120, it is assessed as Near Threatened (NT).

2. ***Gladiolus candidus*** (Rendle) Goldblatt in Lebrun & Stork, Énum. Pl. Fl. Afr. Trop. 3: 89 (1995).
Synonyms. Acidanthera candida Rendle (1895); *A. ukambanensis* Baker (1898); *Gladiolus ukambanensis* (Baker) Marais (1973); *G. ukambanensis* var. *alatus* Marais (1973).
Vernacular names: bedaḥ (Jibbalī and Dhofārī Arabic).

Description. Geophyte, to 30 cm, with a globose corm about 1–2 cm in diameter covered with reddish brown fibrous tunics. Leaves 4–5, 2-ranked, 15–30 × 0.5–1 cm, lanceolate, margins entire, glabrous, erect to spreading. Scape single with 3–4 flowers in a one-sided spike. Bracts and bracteoles leaf-like, 2–8 cm, suntending the flowers. Perianth white, fragrant, with a long slender tube, six-lobed above; tube 7–10 cm, narrower at base; segments more or less all equal, 2–3 cm, obovate, apex rounded. Stamens 3, inserted in throat of perianth. Ovary 3-locular; styule exserted; stigma 3-lobed. Capsule 1.5–2 cm, obovoid. Seeds reddish brown, triangular, flattened, narrowly winged.

Flowering and fruiting. August.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains, on the summit and slopes, in grassland, in stony and pebbly places. *Altitude*: ± 850 m. Distributed in NE & E tropical Africa. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 288.

Notes. Variations in the colour of perianth and winged, narrowly winged and unwinged seeds are present throughout the range of distribution of this taxon. The corms are gathered in the drier season, cooked and eaten as a well-liked food in Dhofar.

2. **Moraea** Mill.
About 200 species in sub Saharan Africa, the Mediterranean region to the western Himalayas.

Moraea sisyrinchium (L.) Ker Gawl., Ann. Bot. (König & Sims) 1: 241 (1804).
Synonyms. Iris sisyrinchium L. (1753); *Gynandriris sisyrinchium* (L.) Parl. (1854).

Description. Geophyte, 7–15 cm (in flower) with an ovoid corm about 2 cm in diameter covered with fibrous tunics. Leaves usually 2–3, basal, 8–15 × 0.5–1 cm, linear, canalicu-

late, erect to spreading and touching the ground. Scape single with 2–4 flowers. Bracts and bracteoles membranous, 4–6 cm, acuminate, enclosing the buds. Perianth segments bluish purple, usually with a white or yellow patch in the centre of the outer segments; outer segments, 2.5–3.5 cm, obovate to elliptic with a narrow claw, deflexed; inner segments slightly smaller than the outer segments, oblanceolate, erect. Stamens 3, inserted at throat of tube. Stylar branches 3, petaloid, each with 2 triangular lobes at apex; stigma on lower suface of stylar arms at base of the 2 lobes. Capsule 1.5–4 cm, cylindrical to ellipsoid, with a persistent 2 cm long beak. Seeds brown, ellipsoid, compressed.

Flowering and fruiting. February to April.

Distribution and habitat. Northern Oman, Musandam, on mountain slopes, in wadis, runnels and edges of fields, in pockets of sand and silt, and amongst small rocks and stones. *Altitude*: 450–1400 m. Common from N Africa, the Mediterranean region to the western Himalayas. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration. 289.

Notes. In the Oman Plant Red Data Book: 2014, p. 193, it is assessed as Vulnerable (VU C1), for its localised populations that can easily be affected by disturbance to habitat.

18. **Amaryllidaceae**

In the APG IV (2016) classification, Ixiolirion is placed in its own family Ixioliriaceae.

1. **Ixiolirion** L.

A single genus with four species found from Egypt to Turkey and to the western Himalayas.

Ixiolirion tataricum (Pall.) Schult. & Schult.f., J.J.Roemer & J.A.Schultes, Syst. Veg. 7: 752 (1829).

Synonym. Amaryllis tatarica Pall. (1776).

Description. Perennial to 40 cm, with globose bulb-like corms. Leaves pale green, aggregated basally, 3–5, alternate, erect to spreading, 15–30 × 1–2 cm, linear to falcate, sheathing at base, margins entire, glabrous. Inflorescence of a terminal umbellate cluster; scape exceeding the leaves, leafy in the lower part. Flowers bracteate, bracts with membranous margins. Pedicels 1–2 cm. Perianth free, deep bluish violet, 2–3 cm, lobes linear-lanceolate, mucronate, with 3 dark purple mid-veins. Stamens 6, in 2 whorls, filaments free. Style bluish purple, 3-lobed. Capsule oblong, 2–2.5 cm. Seeds many.

Flowering and fruiting. April.

Distribution and habitat. Northern Oman, only known from Musandam, in the mountains, in a sandy and gravelly wadi; not common and recorded only once from Wadi Sih, above Khasab. *Altitude*: ± 1200 m. Widely distributed from the Sinai Peninsula and Turkey, Cau-

causus, central Asia, Arabian Peninsula, Jordan, Palestine to Iraq, Iran, Afghanistan, Pakistan and Kashmir. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia.

Distribution map & Illustration. 290.

Notes. In the Oman Plant Red Data Book: 2014, p. 194, it is assessed as Vulnerable (VU C1), for its localised populations that may be easily be affected by disturbance to habitat.

19. **Aloaceae**[1]

Bibliography

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Miller, A.G. & Morris, M. (1988). Plants of Dhofar. Diwan of Royal Court. Oman.

In the APG IV (2016) classification, Ixiolirion is placed in the Xanthorrhoeaceae.

Aloe L.

About 450 species in Africa, Arabia, Madagascar and certain of the smaller islands of the Indian Ocean.

1. Plants stemless or with very short, decumbent stem in old specimens 2
   Plants with long procumbent or pendent stems 4
2. Plants offsetting and forming groups ..... 3. **A. vera**
   Plants solitary or occasionally with 2 or 3 rosettes by division 3
3. Leaves ascending to erect, inflorescences with 3-4 erect lateral branches ..... 1. **A. dhufarensis**
   Leaves spreading to ascending, inflorescences divaricately many-branched ..... 2. **A. praetermissa**
4. Leaves to 50 cm long, inflorescences branched, flowers red ..... 4. **A. collenetteae**
   Leaves to 25 cm long, inflorescences unbranched, flowers cream . 5. **A. whitcombei**

1. ***Aloe dhufarensis*** Lavranos, Cact. Succ. J. Amer. 39: 167 (1967).

Vernacular names: sabr; tuf (Jibbālī)

Description. Plant solitary or occasionally with two rosettes by division. Leaves succulent, smooth, 15–20 in a dense rosette, ascending or erect, blue-green without any spots, triangular with an acute and hard tip, to 45 cm long and 15 cm broad at base, margins entire or with an occasional tooth, flat to slightly concave above, lower face convex. Inflorescence erect, to 125 cm tall, with up to three erect lateral branches; racemes long, densely flowered; bracts triangular, scarious, to 10 mm long; pedicels 8–15 mm long. Flowers red, cylindrical, about 30 mm long, outer segments free for 20 mm. Capsule 15–18 × 9 mm. Sap yellow, drying orange-yellow.

[1] J. Lavranos, Pretoria, South Africa.

Flowering and fruiting. March, April but also, less frequently, in November and December.

Distribution and habitat. Southern Oman, in Dhofar in arid valleys and on dry ridges from the summit plateaux of Jabal Samhan to the Yemeni border, in open, rocky places. Old plants have been observed in the Wadi Ayun and northwards to the fringes of the *Boswellia* zone. *Altitude*: near sea level to 1500 m. An Arabian endemic found also in the Al-Mahra province of Yemen.

Distribution map & Illustration. 291; Miller & Morris, l.c., p 183.

Notes. The sap of this species is used for medicinal purposes.

2. ***Aloe praetermissa*** McCoy & Lavranos, Cact. Succ. J. Amer.74: 51 (2002).
Synonyms. Aloe inermis sensu auctt. non Forssk. (1775); *A. luntii* sensu auctt. non Baker (1895)
Vernacular names: sabr, sekel; síkel (Jibbāalī).

Description. Plant solitary or occasionally with up to three rosettes by division. Leaves succulent with a smooth surface, up to 20 in an open rosette, spreading or ascending, blue-gray without any spots in mature plants, broadly triangular with an acute and often slightly recurved apex, to 40 cm long and to 12 cm broad at base, margins entire or with a few white or pink teeth and a pink cartilaginous border, flat or slightly concave above, lower face convex. Inflorescence erect or produced at a slant, up to 120 cm tall, with 10–30, divaricately spreading branches that are often re-branched; racemes rather short, laxly flowered, flowers often sub-secund; bracts ovate, acute 5–8 × 2.5 mm; pedicels 10 mm long. Flowers red, often yellow at the mouth, glabrous, averaging 25 mm, outer segments free for 7 mm. Capsule 20 × 5 mm. Sap yellow, drying black.

Flowering and fruiting. October, November.

Distribution and habitat. Southern Oman, in Dhofar, in slightly more humid places on rock outcrops in dense forest, on cliff faces and in subhumid grassland. *Altitude*: 75–1000 m. Endemic to Dhofar, where it has been observed from Sarfayt in the west to near Hasik in the east.

Distribution map & Illustration. 292; Miller & Morris, l.c., p. 185.

Notes. Miller & Morris (l.c.) assign this species to *A. inermis* Forsskål.

3. ***Aloe vera*** (L.) Burm.f., Fl. Indica: 83 (1768).
Synonyms. A. perfoliata L. var. *vera* L. (1753); *A. barbadensis* Mill. (1768).
Vernacular names: sabr, subr (Arabic).

Description. Plant acaulescent or with decumbent stems to 50 cm, offsetting freely and forming dense, often very large groups. Leaves succulent, with a smooth surface, 15–20 in a tight rosette, ascending to erect, grey-green, often with a few pale spots low down, lanceolate, tapering to a point, to 60 cm long and to 7 cm broad at base, margins with white deltoid teeth, 3 mm long, 5–10 mm apart. Inflorescence erect, 100–140 cm, with 2–3 branches

from about the middle; racemes cylindrical, rather densely flowered, to 25 cm long; bracts deltoid, 6–8 × 3.5 mm. pedicels 7 mm long. Flowers sharply deflexed. Perianth segments yellow (sometimes red), glabrous, 30–32 mm; outer and inner perianth segments connate for about a third to half their length. Capsule not seen. Sap yellow, drying yellow-brown.

Flowering and fruiting. September to November.

Distribution and habitat. Northern Oman, in the foothills of the Hajar mountains, on rocky slopes; common in the Wadi Mistal, Ghubrah Bowl, in villages around Nizwa, and above Tiwi; cultivated in private homes and public places. *Altitude*: 50–800 m. An Arabian endemic also found in Yemen and Saudi Arabia.

Distribution map & Illustration. 293; Collenette, l.c., p 23.

4. ***Aloe collenetteae*** Lavranos, Cact. Succ J. Amer. 67: 33 (1995).

Description. Plants suckering from the base, with stems up to 120 cm long. Leaves succulent, with a smooth surface, 5–7 in an open rosette, spreading or pendent, ensiform and often falcate, tapering to a sharp point, bright green with a few pale spots, to 50 cm long and 5 cm broad at base, margins with white, cartilaginous teeth, 0.5 mm long and 10 mm apart but obsolete above. Inflorescence at first descending, then upcurved, to 40 cm long, usually bearing 2–3 lateral branches; racemes erect, short, laxly few-flowered; bracts 2–4 mm long; pedicels 5–6 mm long. Flowers red, glabrous, 20 mm long, cylindrical and slightly constricted at the mouth, outer segments free for 7 mm. Capsule 12 mm long. Sap clear, drying yellow.

Flowering and fruiting. October.

Distribution and habitat. Southern Oman, in Dhofar on cliff faces above Dhalqut, the stems hanging with rosettes of leaves turned sideways. Although a few plants have been found in grassland above the cliffs, *A. collenetteae* clearly is a cliff-dwelling species, and is a very narrow endemic. *Altitude*: ± 800 m.

Distribution map & Illustration. 294.

5. ***Aloe whitcombei*** Lavranos, Cact. Succ. J. Amer. 67: 31 (1995).

Description. Plants suckering from the base, with stems to 40 cm long. Leaves very succulent, rigid with a smooth surface, light green copiously covered with pale spots 5–8 in a dense rosette, narrowly deltoid with rounded apex, to 80 mm long and 15 mm broad at base, margins and apex bearing many soft teeth 0.5 mm and 1–2 mm apart. Inflorescence simple or with a short lateral branch, pointing or arched downward, to 5–25 cm long; racemes always pointing or curving obliquely downward, conical, rather dense, 30–60 mm long with up to 50 flowers; bracts 4 mm long, 2.5 mm broad; pedicels 4–5 mm long. Flowers whitish, glabrous, 14 mm long, cylindrical, 4 mm in diameter throughout their length, outer segments free for 6 mm. Capsule 10 mm. Sap clear, drying yellow.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, in Dhofar, a very narrow endemic confined to a short section of the upper vertical cliff face at Shaat above Ra's Sajr. *Altitude*: 800–900 m.

Distribution map & Illustration. 295.

Notes. A remarkable species, both in its choice of habitat and by the fact that all its parts, vegetative and floral, point downward. In all other *Aloe* species known that grow on cliffs, the inflorescences may first grow downward but then curve up, the racemes being held upright or in an ascending position.

20. **Agavaceae**

Bibliography

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In the APG IV (2016) classification, *Dracaena* and *Sanseviera* are placed in the Asparagaceae.

Tree; trunk forked repeatedly; leaves congested in dense rosettes at the tips of branches ... . 1. **Dracaena**
Acaulous shrub; leaves distichous, not in rosettes ..... 2. **Sansevieria**

1. **Dracaena** Vand. ex L.

Forty species distributed from the Old World tropics to the Canary Islands; single species in America.

Dracaena serrulata Baker in Kew Bull. 1894: 342 (1894).
Vernacular names: ʿariyeb (Dhofārī Arabic); ʿayrob (Jibbālī).

Description. Tree, up to 5 m, slow growing. Trunk single, forked above; trunk and branches thick, covered with remnants of hardened leaf-bases. Leaves overlapping and congested on the tip of branches, stiff and rigid, glabrous, sessile; lamina 50–100 × 2–5 cm, ensiform, flat or concave on the adaxial surface, convex on the abaxial surface, margins minutely serrulate or sometimes entire, the lower part of leaf brownish-green and dilated at the place of attachment. Flowers in large terminal, erect panicles, up to 1.5 m, with each flower ± 5 mm long. Perianth 6, pale pink to pink-green, 15–20 mm, segments lanceolate, united below to form a short tube; stamens 6, inserted on top of the perianth tube; ovary ovoid, 3-locular. Fruit a berry, 5–6 mm in diameter, globose, fleshy, red when ripe, 1–3-seeded.

Flowering and fruiting. Flowering is sporadic and occurs after sufficient rain.

Distribution and habitat. Southern Oman, Dhofar, restricted to high altitudes in the drier parts of the mountains, often growing in association with *Acacia ethaica* and *Grewia erythraea*, common. *Altitude*: 300–800 m. An Arabian endemic, also found in Saudi Arabia and Yemen.

Distribution map & Illustration. 296.

Notes. Baker, l.c. separates *D. serrulata* from *D. ombet* on the basis of its serrulate leaf margins. Collenette (1999) records *D. ombet* rather than this species from Saudi Arabia. The name *D. serrulata* is based on material collected from Yemen by J.T. Bent (holo. K).

In earlier times the leaves were used as an important source of fiber for making rope and twine. Severely damaged trees have been observed on Jebel Semhan (Dhofar mountains) in the last 15 years (1995–2015). The new leaves are cut for camel fodder and many trees have been left badly damaged. No apparent regeneration is observed on Jebel Semhan or on Jebel Qara. Overgrazing has to be controlled in these areas in order to conserve this species.

2. **Sansevieria** Thunb.

Twelve species, distributed in the dry tropical regions, S Africa, Madagascar, S Asia and Arabia.

Sansevieria ehrenbergii Schweinf. ex Baker in J. Linn. Soc. 14: 549 (1875).

Vernacular names: seyteh (Dhofārī Arabic); sebteh (Jibbālī).

Description. Perennial rhizomatous succulent, up to 1 m, acaulous. Leaves arising from a prostrate rhizome, distichous, 4–7 in number, rigid and succulent when mature, glabrous, with a long channel throughout the length and shallow channels on either sides on the upper surface, concave on the inner surface, margin of channel red-brown, with white membranous border; leaves 50–100 cm, margins red, apex hard and spiny. Inflorescence a lax panicle; flowering axis leafless, up to 1 m long; flowers in clusters on the axis, subpedicellate; perianth 6, 12–14 mm, tubular, segments oblong, green, tinged pink or red, tubular, united below into a short tube; stamens 6, attached to the base of the perianth-lobes. Fruit 10-15 mm in diameter, globose to subglobose, green, 1–4-seeded.

Flowering and fruiting. March to April; the flowers open at night.

Distribution and habitat. Southern Oman, Dhofar, on low dry limestone hills along the coastal plain. *Altitude*: 50–800 m. Distributed in tropical E and NE Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 297.

Notes. Occasionally the leaves are used for extracting fibre and for making ropes. This practice, common in older times, is largely discontinued now as ropes are cheaply available throughout Arabia. The name of the species is based on material collected from Yemen by G. Schweinfurth.

Cultivated species

Agave sisalana Perrine and some species of *Sansevieria* are commonly cultivated in public places and private gardens.

21. **Orchidaceae**

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1. Plants with pseudobulbs ..... 2. **Eulophia**
   Plants without pseudobulbs 2
2. Single leaf developing after inflorescence and fruit set ..... 4. **Nervilia**
   Leaves developing before inflorescence and fruit set 3
3. Plants usually more than 50 cm; stems erect to scrambling, leafy throughout; sepals green with purplish to maroon margins ..... 1. **Epipactis**
   Plants less than 50 cm; stems not leafy; sepals greenish ..... 3. **Habenaria**

1. **Epipactis** Sw.

About 25 species in tropical Africa, Europe, Asia across to Japan and North America.

Epipactis veratrifolia Boiss. & Hohen., Diagn. ser 1, 13: 11 (1853).
Synonyms. Epipactis somaliensis Rolfe in Dyer (1897); *E. abyssinica* Pax (1907).

Description. An erect to scrambling terrestrial herb, 20–100 cm with a creeping rhizome. Stem erect, leafy throughout, 8–20-leaved. Leaves developing before inflorescence, 10–28 × 1–3(–6) cm, plicate, linear-lanceolate, acuminate, sheathing at the base, prominently veined on lower surface, upper leaves merging into the bracts. Inflorescence 9–24 cm, lax, many-flowered; rachis pubescent; bracts 5(–15) × 0.3–1 cm, reflexed or spreading, lanceolate to narrowly elliptic, acuminate, pubescent. Flowers becoming pendulous with age. Pedicel, ovary and outer surface of flower densely pubescent. Sepals green with purplish to maroon margins; dorsal sepal 10–20 × 4–7 mm, lanceolate, acute to obtuse; lateral sepals 10–20 × 4–8 mm, obliquely ovate, acute. Petals 10–20 mm, ovate, acute. Fruit cylindrical, ribbed, splitting lengthwise.

Flowering and fruiting. February to April.

Distribution and habitat. Northern Oman, in the Western and Eastern Hajar mountains, in moist and shady locations, below limestone cliffs in seepages, along wadi banks, near springs and irrigation channels. *Altitude*: 400–700 m. Widespread from Cyprus and Turkey in the west, eastwards to the Himalayas, and southwards to the Arabian Peninsula and the horn of Africa. Elsewhere in the Arabian Peninsula found in the UAE, Yemen.

Distribution map & Illustration. 298.

Notes. Though not rare in Oman, the populations are very localised where found; only a few are known from the Western Hajar mountains and perhaps a single population from the Eastern Hajar mountains. It is assessed as Vulnerable (VU A4abc) on the Oman National

Red List (2014). Threats include development, man made changes to natural water flow patterns, and drought.

2. **Eulophia** R.Br. ex Lindl.
About 250 species, tropical.

Leaves herbarceous, not stiff and rigid, lanceolate or oblanceolate to elliptic, margins entire; flowers pink; petals and sepals not reflexed nor rolled at apex ..... 1. **E. guineensis** var. **purpurata**
Leaves stiff, linear to linear-lanceolate, deeply channelled above, margins erose; flowers greenish flushed purple; petals and sepals reflexed or rolled at apex ..... 2. **E. petersii**

1. ***Eulophia guineensis*** Lindl. in Bot. Reg. 8: t. 686 (1823) var. ***purpurata*** Rchb. f. ex Kotschy in Sitzungsber. K. Akad. Wiss. Math.-Nat. Cl. 51: 352 (1865).

Description. Terrestrial or lithophytic herb, 30–100 cm tall; pseudobulb 3–6 × 2 cm, ovoid, clustered, with numerous thick fleshy white roots at the base. Leaves developing after the inflorescence, 20–70 × 4–100 cm, lanceolate or oblanceolate to elliptic, acute or acuminate, with slightly prominent veins on lower surface. Inflorescence 30–100 cm, simple, laxly 7–many-flowered. Bracts 1–3 cm, lanceolate, acuminate. Flowers showy. Sepals and petals similar, green flushed purple or brown, 20–30 × 3–5 mm, reflexed or spreading, lanceolate, acute. Lip pink to reddish purple marked with pink or purple at base and on veins, 20–40 × 16–40 mm, broadly obovate or almost orbicular, broadly rounded or slightly emarginate at apex, margins undulate; spur 15–30 mm, slender with a broad mouth, ± straight. Column to 5 mm, stout; anther cap bilobulate at apex.

Flowering and fruiting. July/August.

Distribution and habitat. Southern Oman, Dhofar, in *Anogeissus* woodland, in moist and sheltered locations in small gorges and mountains along the coast, in pockets of litter on exposed rocks or between cracks in rocks. *Altitude*: 200–800 m. Found in Sudan and Ethiopia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 299.

Notes. Eulophia guineensis var. *guineensis* is a widespread, forest floor species distributed from West Africa east to Uganda, and south to Angola and Tanzania, but is not recorded from Arabia. *Eulophia guineensis* var. *purpurata* is assessed as Near Threatened (NT) on the Oman National Red List (2014). No immediate threats have been identified, however long term monitoring and conservation of its habitat is strongly suggested.

2. ***Eulophia petersii*** (Rchb. f.) Rchb. f. in Flora 48: 186 (1865).
Synonyms. Galeandra petersii Rchb. f. (1847); *Orchis viridis* Forssk. (1775), non Crantz (1769) nom. illeg. — Type: Yemen, M'harras [Nagd al Ahmar, Taiz-Ibb], *Forsskal* s.n. (holo. C).

Description. Terrestrial or lithophytic herb up to 3 m tall; pseudobulbs 3–24 × to 7 cm, ovoid to cylindrical or narrowly ellipsoid, sulcate, covered with grey caducous sheaths, 2–3-leaved towards apex, drying yellow to orange. Leaves stiff, spreading or ±erect, up to 55 × 1–5 cm, linear to linear-lanceolate, acute, deeply channelled above, margins erose. Inflorescence to 2 m tall, branched or rarely simple, laxly many-flowered; peduncle stout. Bracts up to 5 mm, ovate to lanceolate. Flowers fragrant. Sepals green flushed purplish, with purple veins, 2–3 cm, narrowly oblanceolate or linear, ± apiculate; lateral sepals oblique at base. Petals greenish flushed with purple, purple-veined, 16–22 mm, narrowly oblong, acute to subacute; petals and sepals recurved and rolled at the apex; lip 16–30 × 8–15 mm, 3-lobed; side lobes narrowly oblong, erect, slightly reflexed in front; mid lobe narrowly oblong to transversely oblong, obtuse, margins crisped; spur 2–8 mm, cylindrical, slightly incurved. Column ± 1 cm; anther bilobed at the apex. Fruit ellipsoid, recurved, purplish with greenish grooves.

Flowering and fruiting. May to June.

Distribution and habitat. Southern Oman, Dhofar, on low hills at base of escarpment mountains and in the northward draining wadis, on rocky ground, with succulents such as *Euphorbia cactus*, *Sansevieria ehrenbergii*, *Caralluma flava*; also on rocky slopes in dense *Anogeissus dhofarica* woodland and *Acacia-Commiphora* woodland. *Altitude*: 200–1300 m. Widespread throughout tropical Africa from Ethiopia and Sudan to South Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration. 300.

Notes. Easily recognized even when it is not in flower by its large conical-cylindrical pseudobulbs which bear 2 or 3 fleshy rigid leaves. Two colour forms occur in Dhofar, a pink and green flowered form which is widespread, and a brownish pink flowered form which is rarer. *Eulophia petersii* is the most drought tolerant orchid in Arabia. On the Oman National Red List (2014) it is assessed as Near Threatened (NT). No immediate threats have been identified, however long term monitoring and conservation of its habitat is suggested.

3. **Habenaria**[2] Willd.

About 600 species, pantropical and subtropical.

1. Dorsal sepal strongly reflexed ..... 1. **H. myodes**
   Dorsal sepal more or less erect 2
2. Leaves oblanceolate; sepals and petals glabrous ..... 2. **H. malacophylla**
   Leaves elliptic to lanceolate or cordate, not oblanceolate; sepals and/or petals pubescent, ciliate or papillate 3
3. Basal leaf solitary, cordate, appressed to ground ..... 3. **H. keayi**
   Leaves several, mostly cauline, elliptic to lanceolate ..... 4. **H. cultrata**

[2] C. Coston & S.G. Knees, Royal Botanic Garden, Edinburgh

1. ***Habenaria myodes*** Summerh., Kew Bull. 16: 287 (1962).
Vernacular names: ḥarot, ḥari (Jibbalī).

Description. Terrestrial herbs, 30–55 cm. Leaves lanceolate to narrowly ovate, clasping the stem. Inflorescence cylindrical, 8–25 cm, laxly several- to many-flowered. Flowers green, white in centre. Bracts extending past pedicel but not ovary. Sepals all reflexed; dorsal sepal half the length of laterals, 4.5–7.5 × 2–4 mm, slightly keel-shaped. Petals bilobed to base; upper lobe erect or reflexed, 5.5–7 × 0.5–1 mm; lower lobes spreading 9–18 × 1.5 × 2.7 mm; lip 3-lobed, deflexed, all lobes linear; mid lobe 9–17 mm, lateral lobes 6–12 mm; spur 12–20 mm, inflated towards tip. Column with 2 pollinaria and 2 free, club shaped stigmatic processes. Ovary 12–14 mm, forming an angle with pedicel.

Flowering and fruiting. September to October.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains, in *Anogeissus* woodland, in shaded locations. *Altitude*: 750–850 m. Distributed in tropical and southern Africa. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 301.

Notes. On the Oman National Red List (2014) it is assessed as Near Threatened (NT). No immediate threats have been identified, however long term monitoring, survey and conservation of its habitat is suggested.

2. ***Habenaria malacophylla*** Rchb.f., Otia Bot. Hamburg.: 97 (1881).

Description. Plant 30–100 cm, glabrous. Leaves oblanceolate, thin, soft and mainly in middle of stem. Inflorescence many-flowered. Bracts 9–20 mm, shorter than flowers. Flowers green, pedicel and ovary 10–17 mm. Dorsal sepal erect, or nearly so, 3–4 × 2.5–4.5 mm; lateral sepals deflexed 4–7.5 × 1.5–3 mm. Petals bipartite, posterior lobe adnate to dorsal sepal, 3–7 × 0.5–1.5 mm; anterior lobe curved upwards 4–9.5 mm, narrower than posterior; lip 3-lobed, projecting outwards; mid lobe 4–7 mm, side lobes equal to or slightly longer the mid lobe; spur 8–12 mm, up to 18 mm.

Flowering and fruiting. September to October.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains in *Anogeissus* woodland, in shaded locations. *Altitude*: 750–850 m. Tropical and south Africa. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 302.

Notes. Assessed as Near Threatened (NT) on the Oman National Red List (2014) with no immediate threats identified. However long term monitoring, survey and conservation of its habitat is suggested

3. ***Habenaria keayi*** Summerh., Bot. Mus. Leafl. 14: 217 (1951).
Vernacular names: ḥarot, ḥari. (Jibbalī).

Description. Plant up to 25 cm. Stem densely pubescent. Leaf solitary, cordate to broadly cordate, adpressed to ground. Inflorescence laxly 8–17-flowered, developing after leaf. Bracts pubescent, 10–15 × 3.5–6 mm. Flowers green and white. Pedicel and ovary pubescent 10–15 mm. Dorsal sepal erect or nearly so, 7–8 × 4–4.5 mm, pubescent; lateral sepals 7.5–9 × 3–3.5 mm, pubescent. Petals bipartite; posterior lobe adnate to dorsal sepal, 7.5–9 × 0.5–1 mm; anterior lobe curved upwards, 8–10.5 × 0.5–0.8 mm; lip 3-lobed; mid lobed reflexed, 10 mm, side lobes spreading, 9.5–12 mm; spur 12–15 mm.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains in *Anogeissus* woodland; rare. *Altitude*: 700–850 m. East and west tropical Africa. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 303.

Notes. Wrongly identified as *Nervilia umbrosa* (Rchb.) Schltr. in Ghazanfar, Annotated Cat. of Vasc. Pl. Oman 1992: p. 128. A rare plant, so far known from a single locality and under threat from livestock farming and drought. It is assessed as Endangered (EN D1) on the Oman National Red List (2014).

4. ***Habenaria cultrata*** A.Rich., Tent. Fl. Abyss. 2: 297 (1850).

Description. Plant 30–60 cm. Leaves cauline, largest in middle of stem, elliptic to elliptic-lanceolate. Inflorescence 10–16 cm, laxly many-flowered. Bracts shorter than pedicel. Flowers greenish, sometimes cleistogamous. Dorsal sepal erect or nearly so, 3.5–4.5 × 1.5–2.6 mm; lateral sepals 6–8 × 4–6 mm, reflexed, slightly pubescent. Petals bipartite, pubescent; posterior lobe 3.5–4 × 0.8 mm, adnate to dorsal sepal, anterior lobe 7.5–11.5 × 2–2.6 mm, deflexed; lip 3-lobed; side lobes 5–7 mm; mid lobe 9–14 mm; spur 12–15 mm.

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains in *Anogeissus* woodland. *Altitude*: ?700 m. East Africa. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 304.

Notes. Collected by Vesey-Fitzgerald from Dhofar in 1943 (BM, K) and not collected since; probably now extinct in Dhofar.

4. **Nervilia** Comm. ex Gaud.

About 60 species in tropical and subtropical Africa, Asia and Australia.

Leaf prostrate or nearly so, 1.5–9 × 3.5–14 cm, reniform to almost orbicular, usually densely pubescent above, (5–)7–16-veined, not pleated ..... 1. **N. crociformis**

Leaf held well above ground, very large, to 22 × 26.5 cm, orbicular (reniform when flattened) to cordate, glabrous, 10–30-veined, heavily pleated ..... 2. **N. bicarinata**

1. ***Nervilia crociformis*** (Zoll. & Mor.) Seidenf., Dansk Bot. Ark. 32, 2, 151 (1978).
Synonym. Bolborchis crociformis Zoll. & Mor. (1846).

Description. Erect terrestrial herb to 10 cm, glabrous except for lip, leaf and subterranean parts. Tuber ovoid, (2–)3–6-noded. Leaf solitary, appearing after flowering, prostrate or nearly so, 1.5–9 × 3.5–14 cm, reniform to almost orbicular, usually densely pubescent above, veins (5–)7–16; petiole 0–6 cm, sulcate. Scape erect, terete, 1-flowered, lengthening to about 20 cm when fruiting. Flower more or less erect, fragrant; bract 1–2 mm. Sepals and petals spreading (closing again after about 8 hours anthesis or earlier if pollinated), ± equal, linear-ligulate, acute, brownish green; lateral sepals oblique, 12–19 mm; petals slightly shorter and narrower; lip 12–18 mm, oblong-cuneate, 3-lobed, white with a yellow centre and often pale purple or purple tinge or markings in the apical area; inner surface more or less covered with thin hairs and a few thicker formations more or less arranged in three rows along the centre of the mid-lobe and ranging from low tubercles to long, acute, tapering emergences of different appearance; lateral lobes obtusely triangular or rounded, sometimes less prominent or absent; midlobe ovate-triangular to ovate, subacute to obtuse; margin crenulate-undulate-fimbriate. Capsule (7–)10–17 mm. (Description from Pettersson 1991).

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, in woodland dominated by *Anogeissus dhofarica*, *Euclea schimperi* and *Cadia*, in moist, shaded locations; not common. *Altitude*: 600–700 m. Distributed throughout tropical and subtropical Africa, Madagascar, Cape Verde Islands, Réunion, Mauritius, India to New Guinea, Australia (Queensland). Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration. 305.

Notes. Only collected a couple of times since the first collection in 1989 (*Miller & Nyberg* M9234 (E, K)) which was sterile (leaf only). The single leaf appears after the inflorescence has died down. On the Oman National Red List (illustr. leaf only, p. 221) it is assessed as Vulnerable (VU A4abc), for its small isolated populations and threats to its habitat from livestock farming, drought and potential climate.

2. ***Nervilia bicarinata*** (Blume) Schltr., Engl., Bot. Jahrb. 45: 405 (1911).
Synonym. Pogonia bicarinata Blume (1859).

Description. Erect terrestrial herb 17–75 cm tall, glabrous except for lip and subterranean parts. Tuber ± spherical or ovoid, 3–7-noded. Leaf very large, to 22 × 26.5 cm, solitary, appearing after flowering, more or less horizontal, held well above ground, orbicular (reniform when flattened) to cordate, always cordate at base, apiculate, glabrous, 10–30-veined, heavily pleated, pleats keeled, ragged near the margin; petiole (2–)5–26 cm, sulcate. Scape erect, laxly (1–)2–12-flowered, with 2-5 sheathing cataphylls, the uppermost one often substituted by a sterile bract up to 4 cm long. Flowers 2–4 cm apart, evenly spaced along

rachis; bracts filiform to lanceolate. Sepals and petals greenish, ±equal, ligulate-lanceolate, acute; lateral sepals slightly oblique, 17–31 mm; petals slightly shorter than sepals; lip greenish white with purple or green venation, ovate, 20–31 mm, obscurely 3-lobed, bearing 2 parallel fleshy pubescent ridges running from base of lip to base of mid lobe; side lobes short, oblong to shortly triangular, obtuse, erect, enclosing column; mid lobe triangular to ovate, acute, recurved. Capsule ± 13 mm. (Description from Pettersson 1991).

Flowering and fruiting. September.

Distribution and habitat. Southern Oman, Dhofar, on the escarpment mountains, in *Anogeissus* woodland, in moist, shaded locations. *Altitude*: 600–800 m. Distributed throughout tropical and subtropical Africa, Madagascar, Comoro Islands, São Tome & Principe, Réunion, Mauritius. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration. 306.

Notes. Collected initially from Khadrafi (*Miller & Nyberg* M9238 (E, K)) which is a sterile specimen. The leaves appear only after the inflorescence has died down. On the Oman National Red List (illustr. leaf only, p. 220) it is assessed as Near Threatened (NT). No immediate threats have been identified, however habitat destruction would threaten the existence of this very localised species.

Distribution Maps

Volume 4
Hydrocharitaceae - Orchidaceae

Fig. 1. Halophila ovalis.

Fig. 2. Potamogeton nodosus.

Fig. 3. Potamogeton pectinatus.

Fig. 4. Ruppia martitima.

Fig. 5. Najas marina.

Fig. 6. Najas flexilis.

Fig. 7. Najas graminea.

Fig. 8. Zannichellia palustris.

Fig. 9. Halodule uninervis.

Fig. 10. Syringodium isoetifolium.

Fig. 11. Thalassodendron ciliatum.

Fig. 12. Nannorrhops ritchieana.

Fig. 13. Arisaema flavum.

Fig. 14. Remusatia vivipara.

Fig. 15. Lemna gibba.

Fig. 16. Aneilema forskalei.

Fig. 17. Commelina forskaolii.

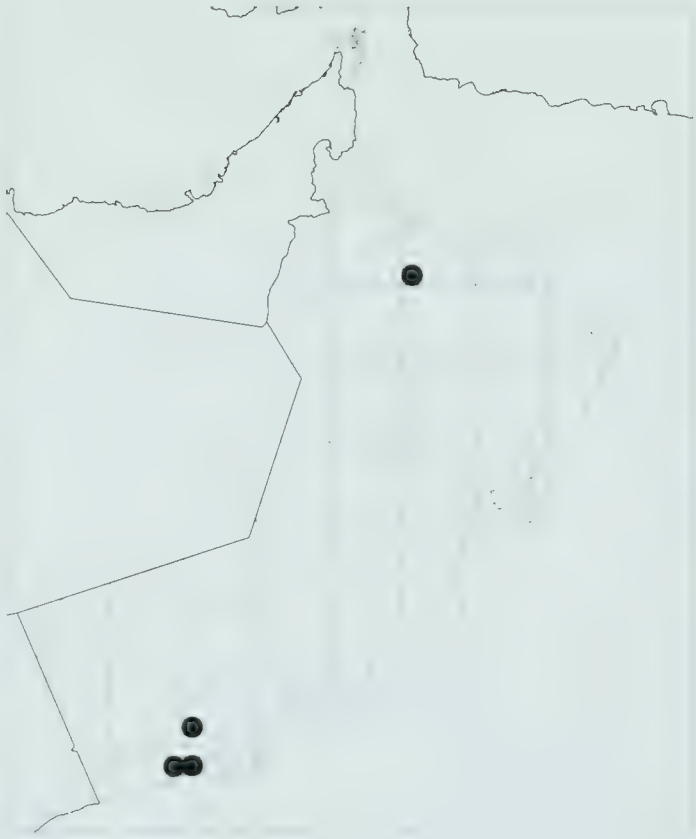


Fig. 18. Commelina albescens.

Fig. 19. Juncus socotranus.

Fig. 20. Juncus rigidus.

Fig. 21. Bolboschoenus maritimus.

Fig. 22. Schoenoplectus litoralis subsp. litoralis

Fig. 23. Schoenoplectus litoralis subsp. thermalis.

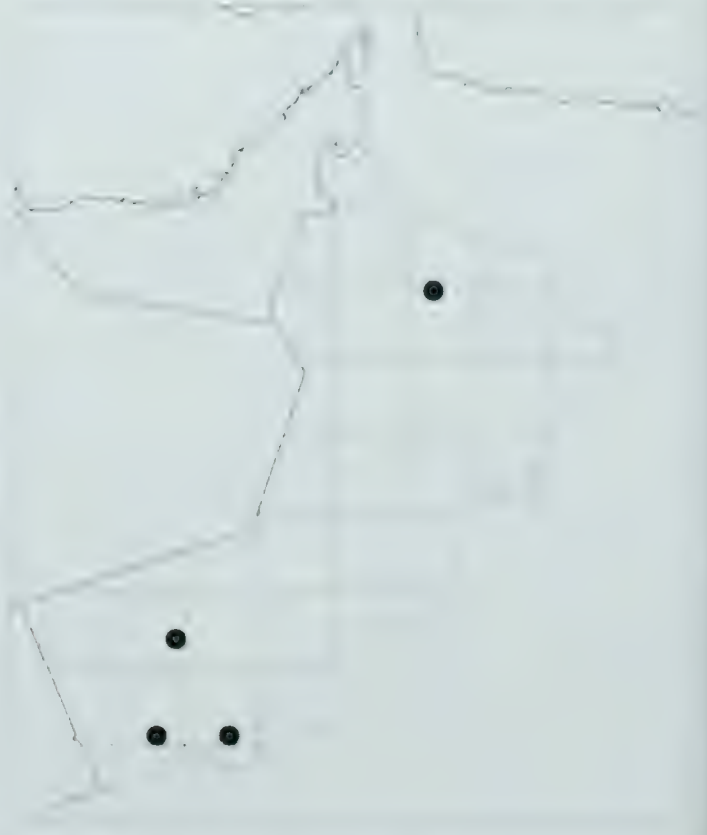


Fig. 24. Eleocharis geniculata

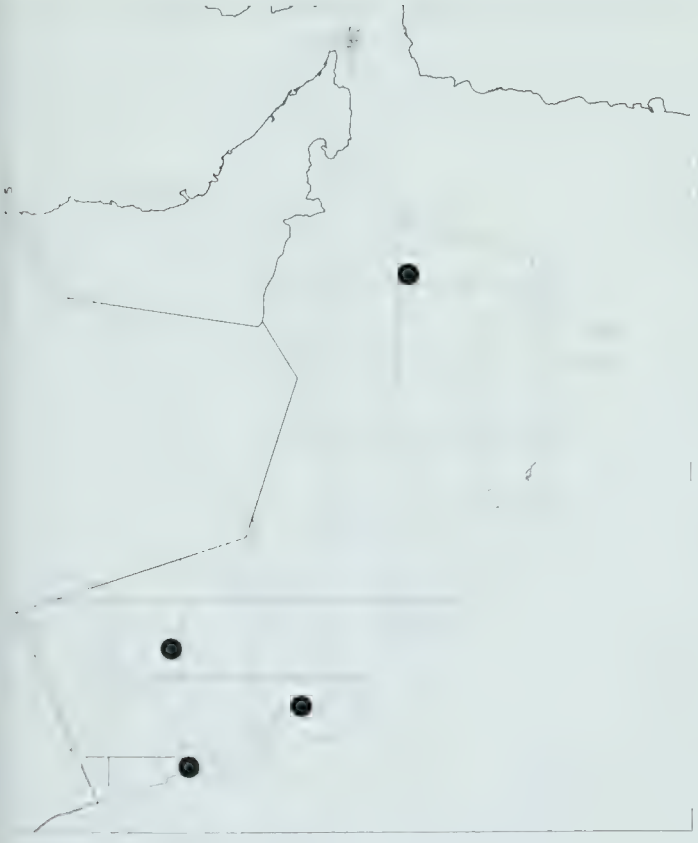
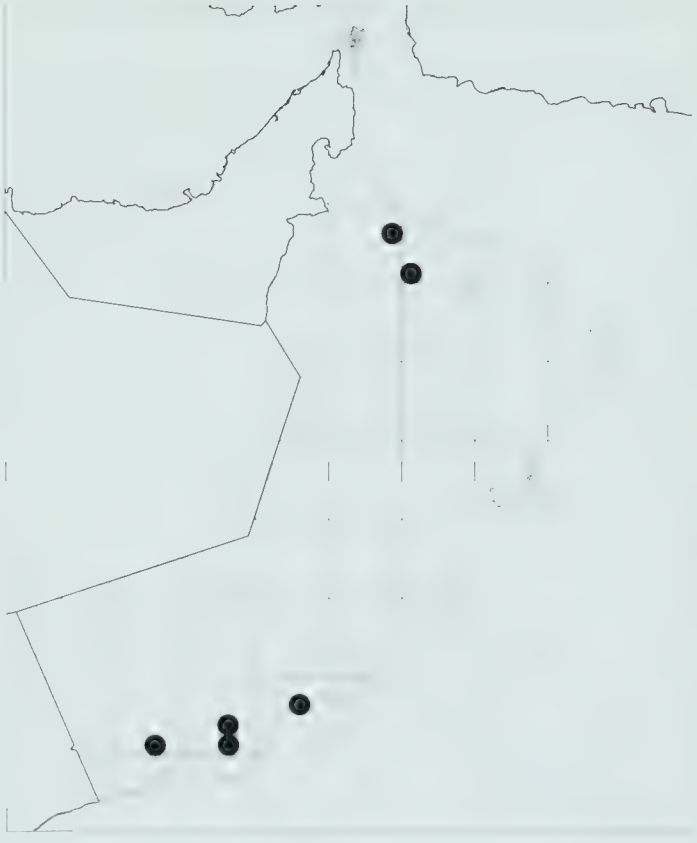


Fig. 25. Fimbristylis cymosa var. spathacea.



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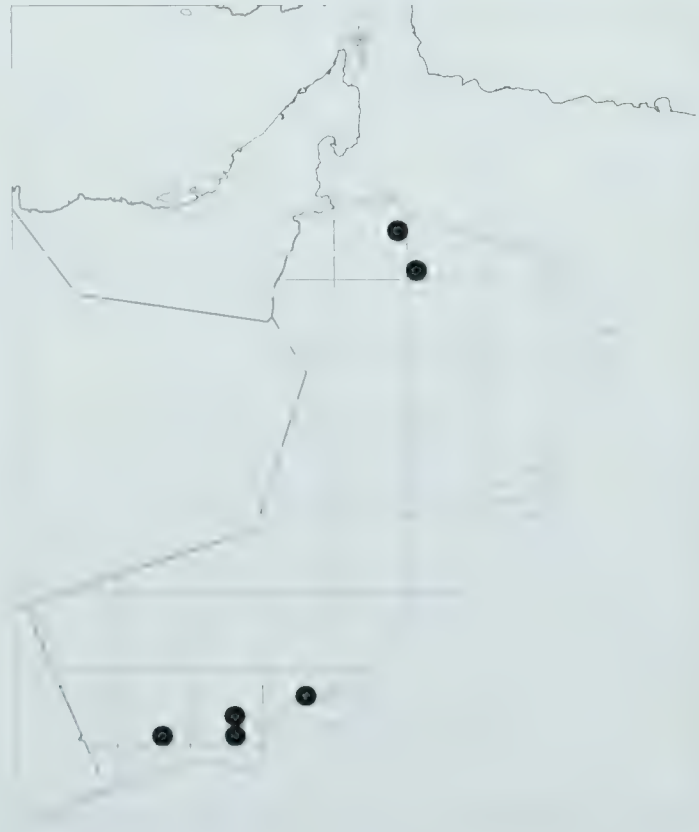

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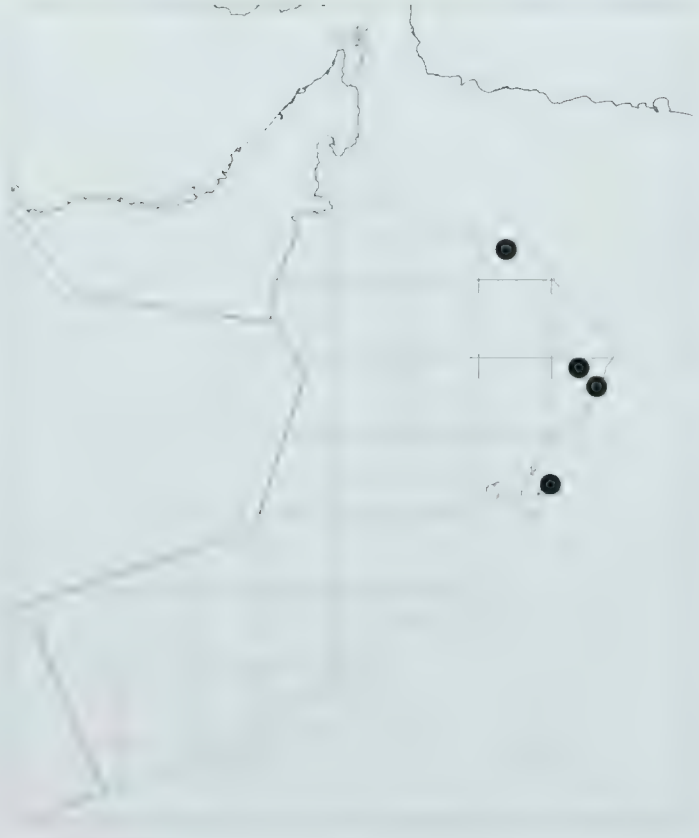

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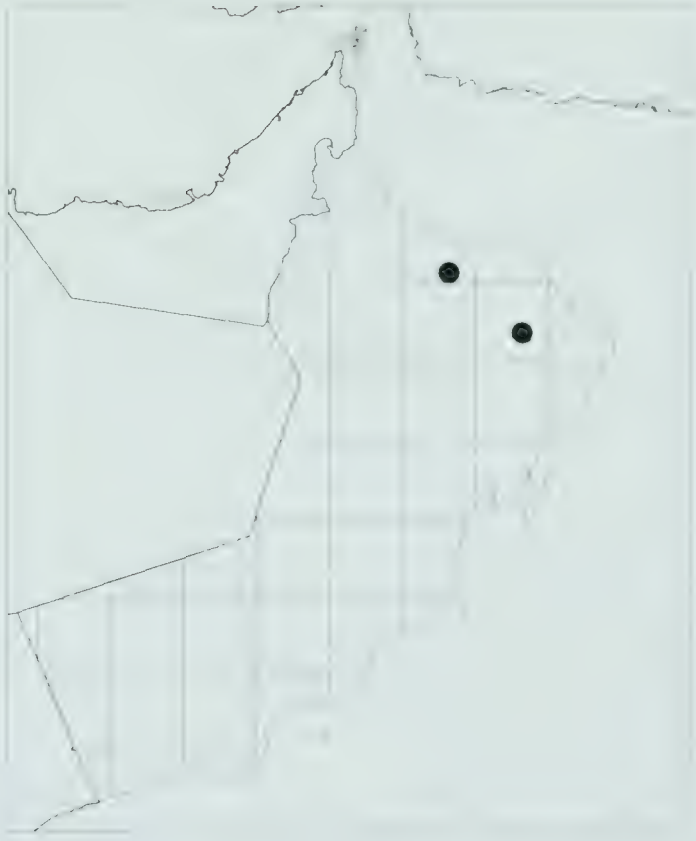

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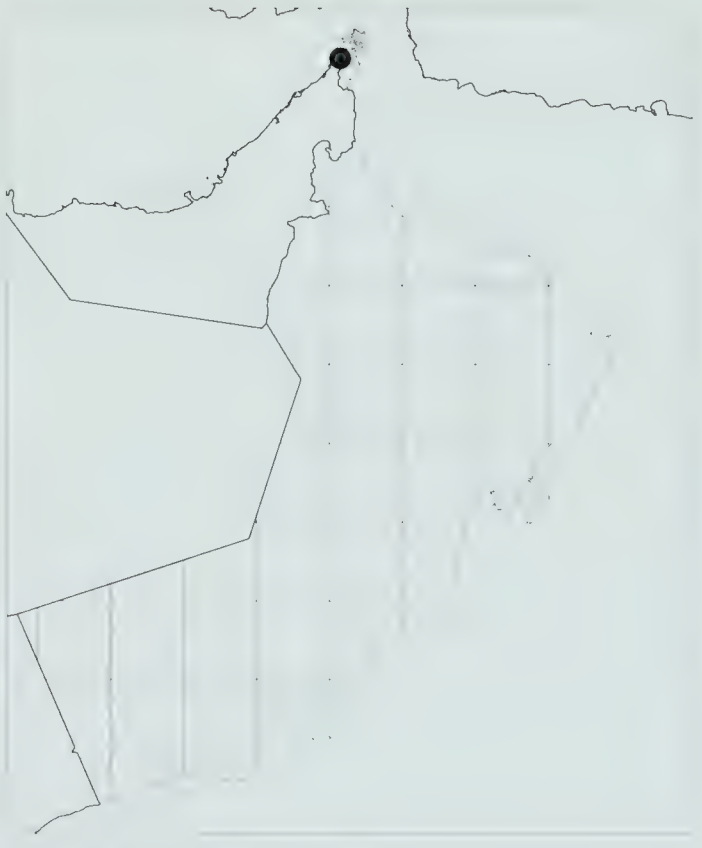

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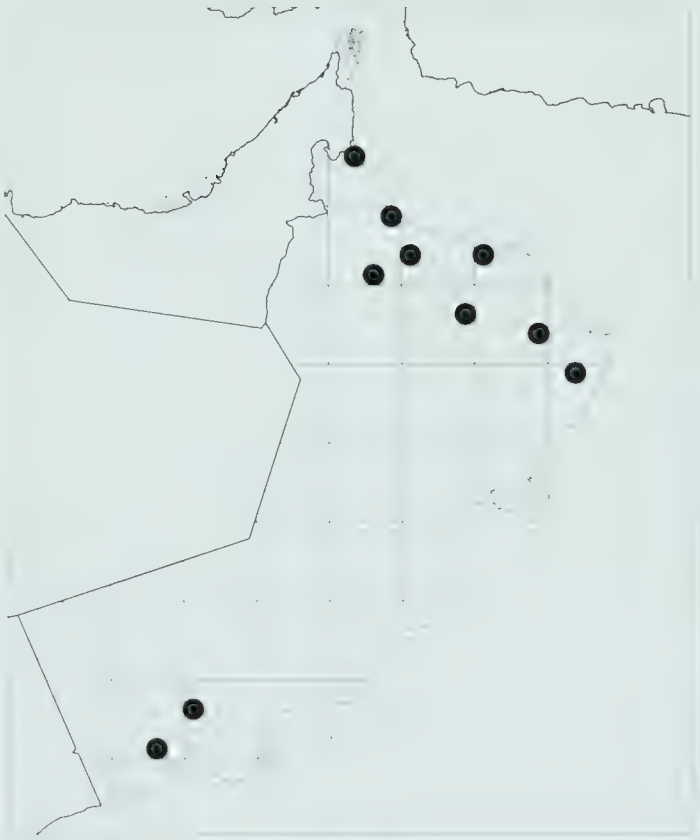

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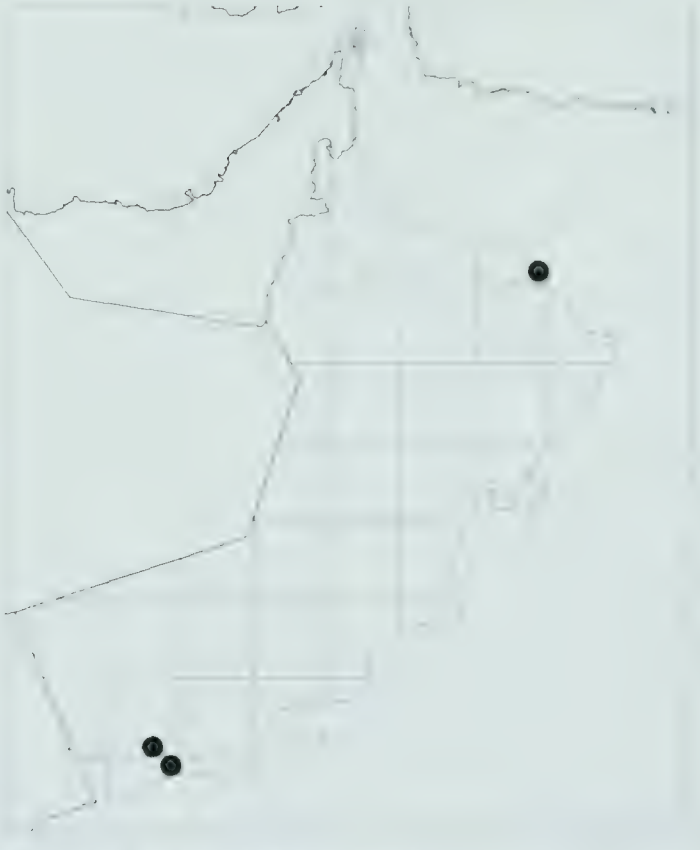

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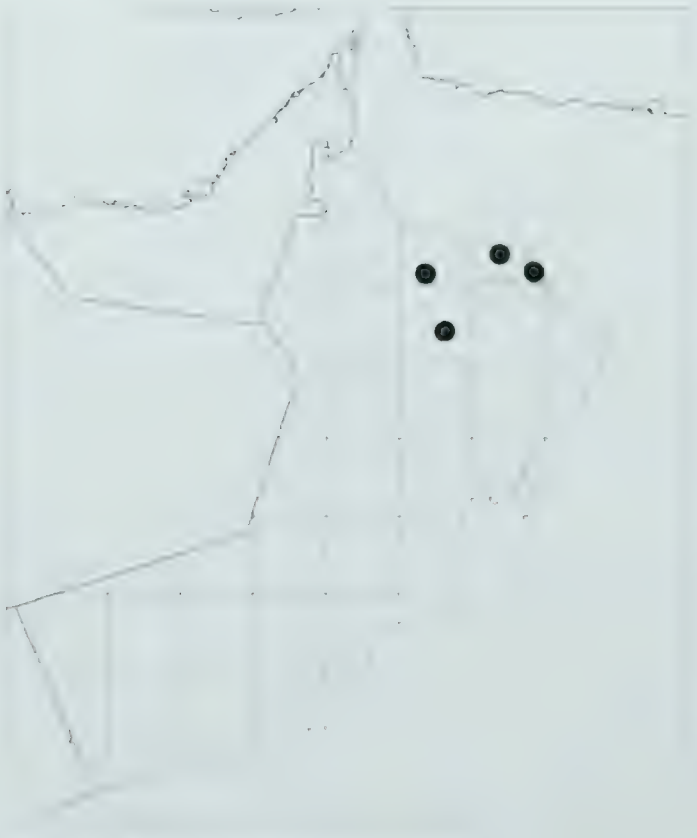

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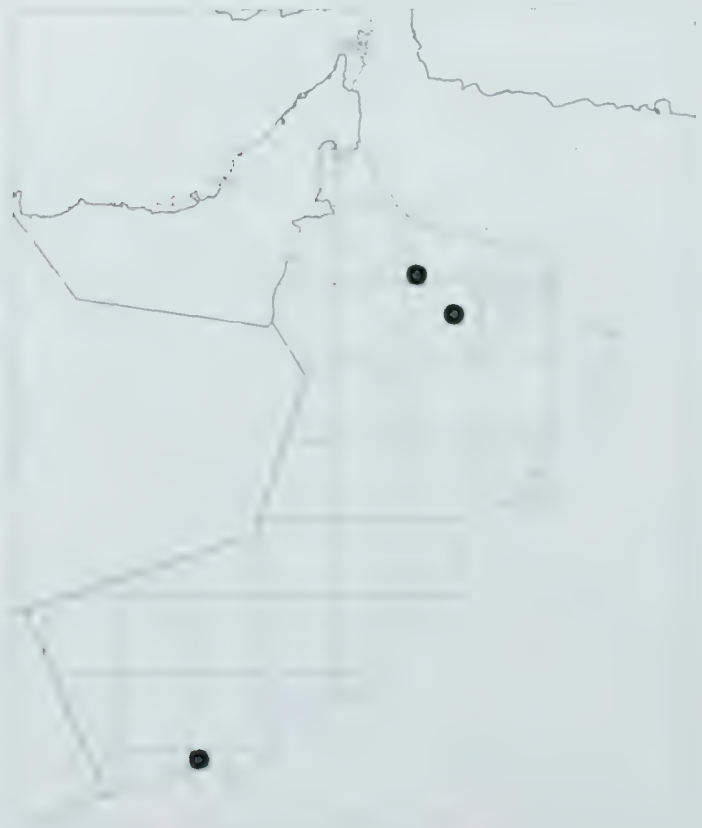

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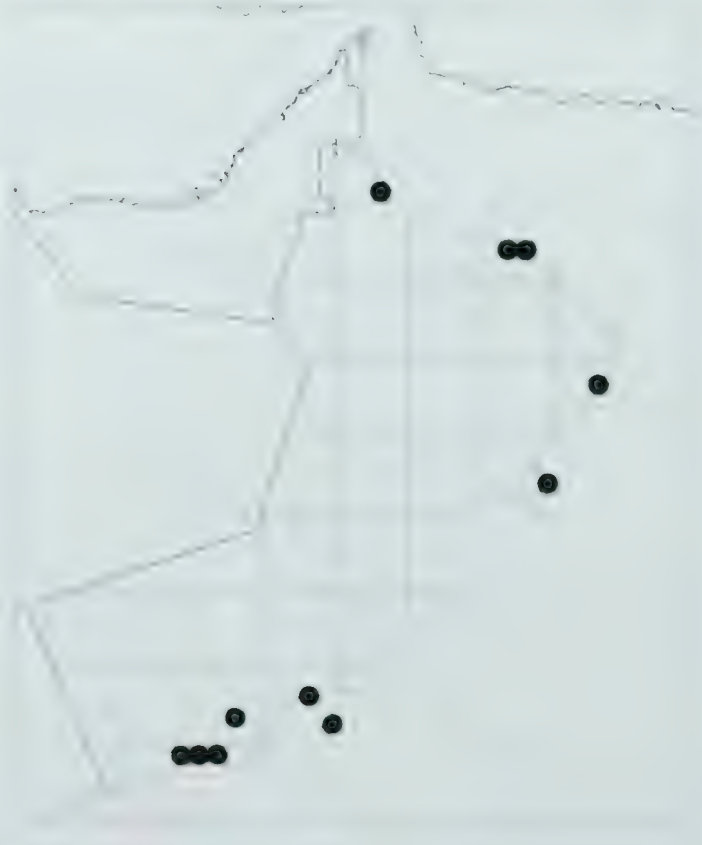

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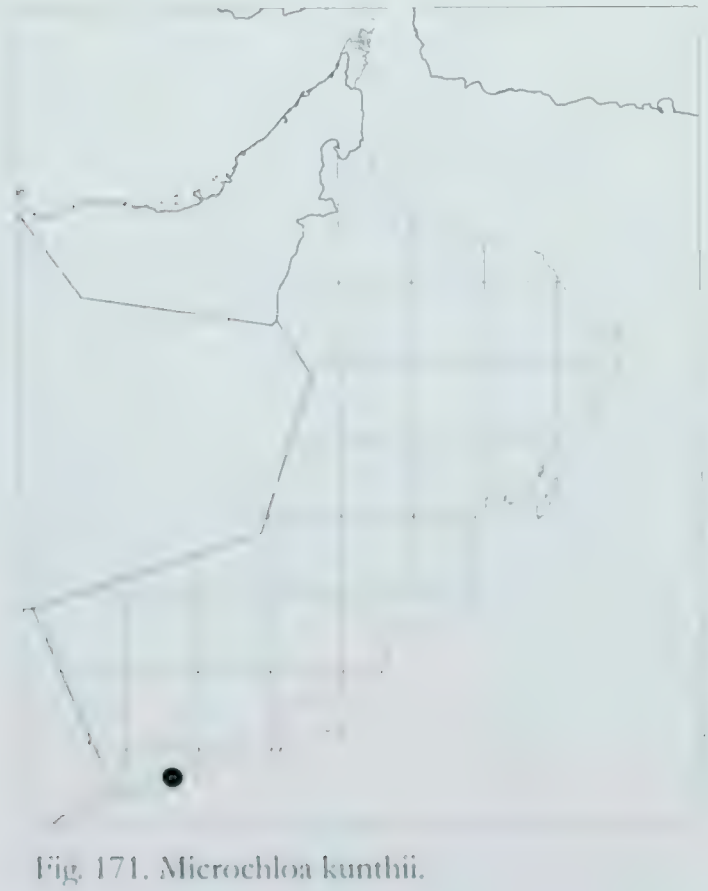

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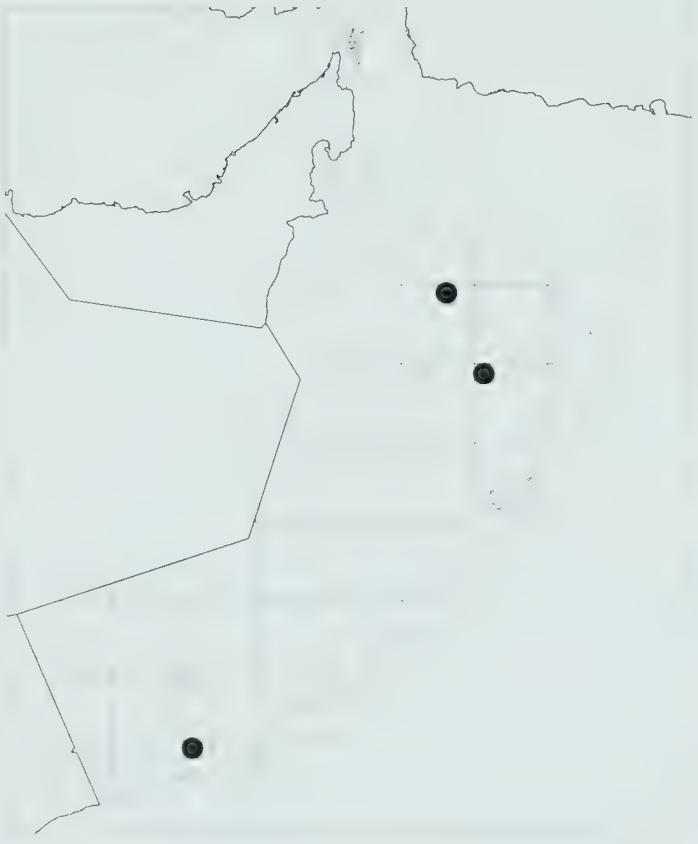

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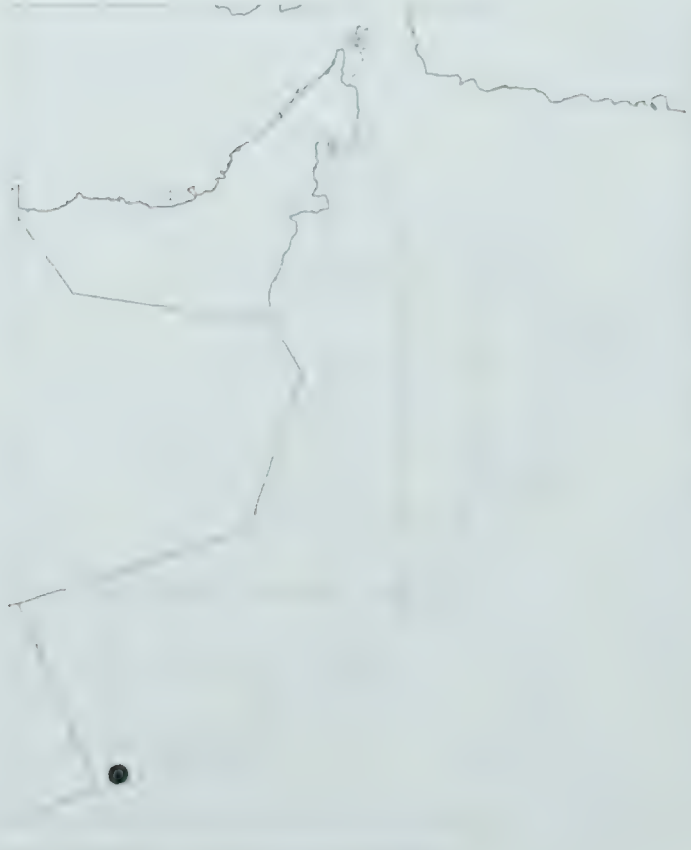

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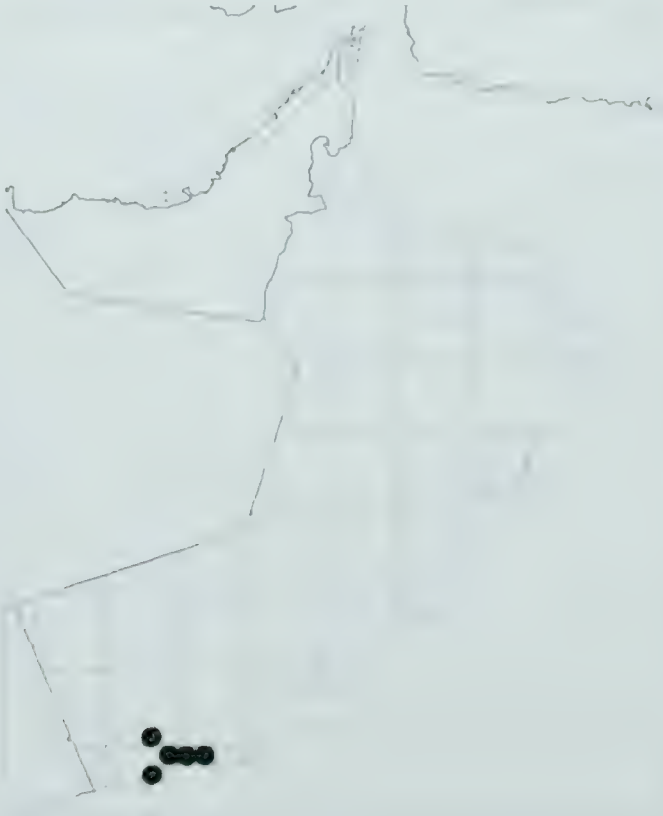

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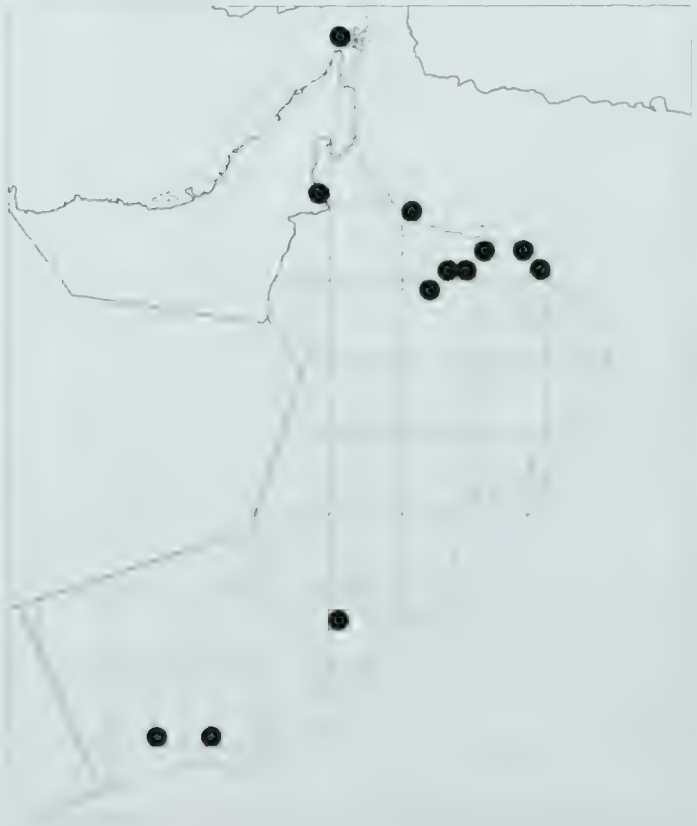

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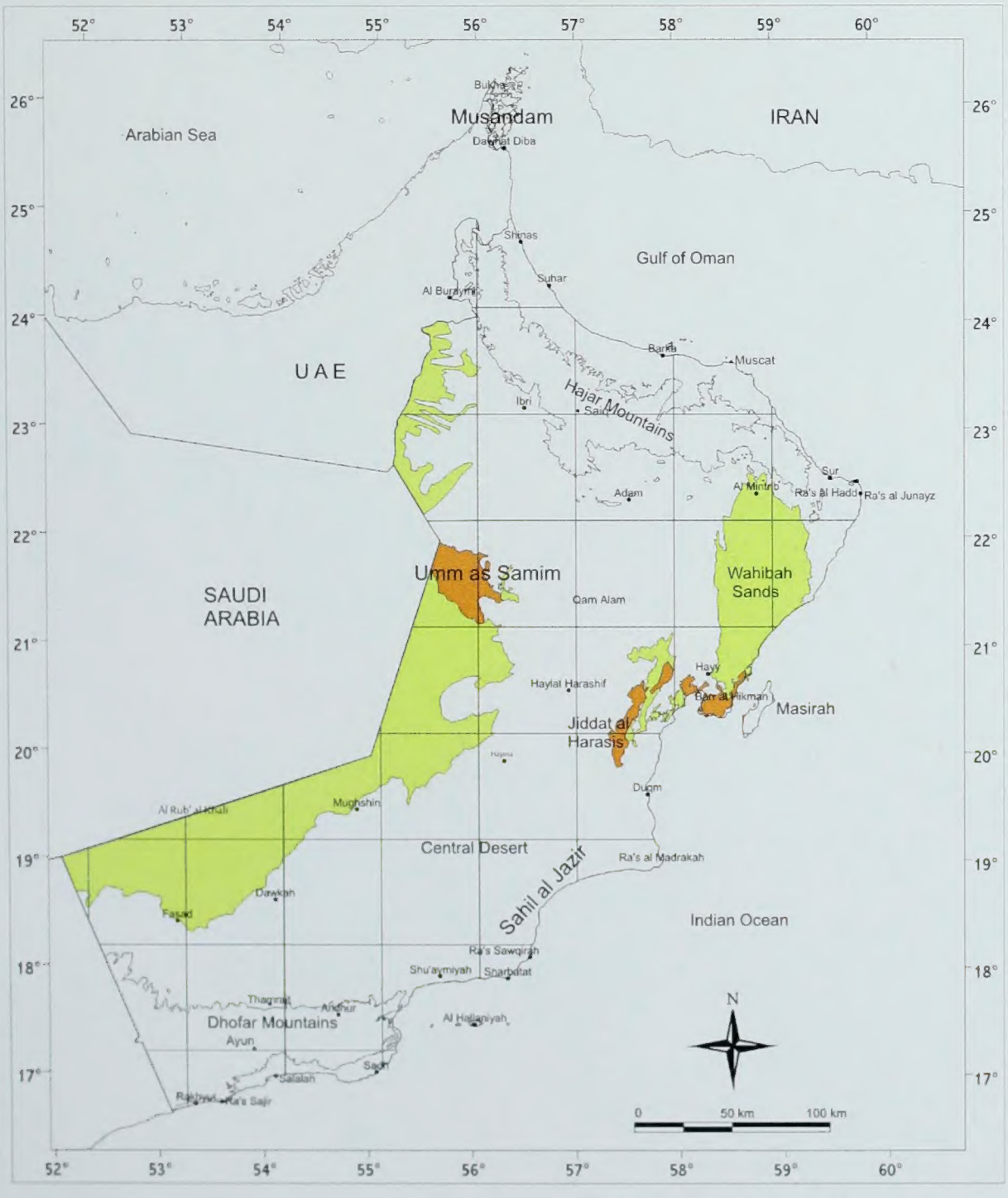

Physical features and main locations of the Sultanate of Oman. Contours of the Hajar, Dhofar and Musandam mountains at 500 m; deep sand and sabkha coloured yellow and orange respectively.

Inside

Map of the main locations of the Sultanate of Oman

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S.A. Ghazanfar

FLORA OF THE SULTANATE OF OMAN

Volume 4

Hydrocharitaceae – Orchidaceae

The fourth and final volume of the Flora of the Sultanate of Oman deals with all petaloid and non-petaloid monocotyledonous families found in Oman. It includes 21 families and 246 taxa, following Cronquist's (1981) system, with explanatory notes where the APG IV (2016) classification or recent molecular evidence treats the families or genera differently. It contains the Poaceae, the family represented by the most (172) taxa found in Oman. For each family keys are provided to all genera and species. Species descriptions are accompanied with notes on distribution, habitat, flowering and fruiting times, conservation status, and uses where relevant. Distribution maps are provided for all described species.

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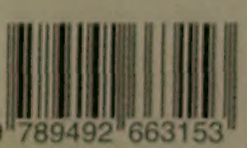
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